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COVER ILLUSTRATION

George Ropes, Jr. (1788-1819)

Launching of the Ship "Fame," 1802

George Ropes was born a deaf-mute in Salem, Massachusetts, and achieved success as a painter after receiving instruction from Michele Felice Cornè. While his principal livelihood came from painting signs and carriages, he also found a market for his landscapes and marine paintings.

This painting, considered one of Ropes's finest works, depicts the 1802 launching of the 363 ton ship "*Fame*" into Salem Harbor from the shipyard of Retire Beckett. The work may have been commissioned by the ship's owners, the Crowninshield family, who had the vessel built in 1802. (See News item, page 141).

Oil on canvas
Peabody Essex Museum Collection
Gift of Nathaniel Silsbee

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Editor's Note

No war in human history incorporated so many international components and spanned the seas so comprehensively as the Second World War. Fighting took place between capital ships and other powerful vessels on the surface while rival submarine forces fought an equally deadly war under the sea. Aircraft launched from land bases or aircraft carriers filled the skies and destroyed enemy vessels on or beneath the sea. The toll in men and ships was enormous on all sides in the Atlantic, the Pacific, and other seas and oceans of the globe. The passage of fifty years since the origin of this world conflict initiated a series of commemorations which began in 1989 and will end next year, a half-century after the end of the war.

Some of these events are celebrations of victories or perseverance; others are tours to major battlefield sites such as Normandy, or concentration camps, or Pearl Harbor, or hundreds of other places which have meaning to the participants, their family members, or those impressed with the significance of the conflict and its outcome.

The naval aspect of the war is more difficult to celebrate because its battle sites consist mostly of watery graves and the twisted wreckage of ships permanently encompassed within the waters of the earth. Midway, Coral Sea, the Battle of the Atlantic are but geographical indications of battlefields which were never exactly fixed and ranged over thousands of square miles of land and sea. In some ways this erases their existence from the historical consciousness because there is no place to visit and envision so exactly the actions such as those at Omaha Beach in Normandy, Casino in Italy, Guam or Iwo Jima in the Pacific. Historians, who are traditionally the authors of paeans to the glory or defeat of armies, navies, and the states they represent, are at a loss sometimes to fill travel sections of the newspapers with suggestions for appropriate commemorative visits in search of the naval past. The Battle of the Atlantic may have been, as Sir Winston Churchill claimed, the battle upon which the war would turn. Only the U-boat war waged there truly scared him, he confessed. Yet there is no one place to revisit the drama of this encounter fought over several years.

There are a few Liberty ships left, representative of those hundreds of merchant vessels sacrificed because of the American determination to supply her allies at a cost which some would argue was too high. Merchant ships with war *matériel* for the Russians and British were torpedoed by U-boats with near impunity during the early phase of the war from 1941 to 1943. The use of convoys and technological advances in radar and sonar, coupled with intelligence breakthroughs which allowed the deciphering of both German and Japanese communications, ultimately led to Allied success.

Searching for a place of commemoration for those involved in the naval or air war is difficult, but a few Liberty ships made their way from the United States to the beaches of Normandy both to acknowledge and to reenact the D-Day landings of June 1944. President Clinton unveiled a monument to U.S. Naval personnel at the American cemetery at Colleville-sur-Mer, while across the Channel in Portsmouth the British dedicated a monument to "The Longest Day."

The cruise ships that crowded the Normandy coasts this spring carrying not marines but tourists acknowledged not only the amphibious assault which echoed in reverse the invasion of England by the Normans in 1066 but also the naval war on all seas. For those unable to journey so far, there are numerous memorials of significance worthy of a visit to catch a glimpse of the action. Memorial vessels such as the submarine USS *Cod* in Cleveland, the aircraft carrier *Yorktown* in Charleston, and the carrier *Intrepid* in New York City are a few of the ships which live as museums on American shores, as do other vessels abroad, to acknowledge the debts of the present to those who sacrificed in the past. Our colleagues in maritime history working through their fine organization the Historical Naval Ships Association (HINAS) have much to be proud of in their efforts to preserve historic vessels and to create visitor centers which educate and inform the public so effectively about the naval side of humanity's struggle against itself.

TIMOTHY J. RUNYAN

Cleveland, Ohio

From Hog Islanders to Liberty Ships:
The American Government and Merchant Ship Construction in Two World Wars

DEBORAH A. HIRSHFIELD

American merchant shipyards played a crucial role in winning both the First and Second World Wars. In contrast to the automobile and aircraft industries, shipbuilding was the only transportation industry to play a pivotal role in both wars, for without the "bridge of ships" to move men and *matériel,* the wars might have been lost.

During both conflicts, the U.S. government directed and, in fact, redefined the industry, first setting policy and standards, then implementing programs that went far beyond merely issuing contracts. The government determined which ship designs would be built and where new yards would be located. Federal agencies funded development of new technologies to speed construction. Stabilizing labor relations became a principal interest, as unions gained legitimacy and power. Redefining and recruiting a new labor force was yet another wartime concern.

Once the national emergencies and mobilization ended, however, and control of the industry was returned to private hands, the federal government quickly abandoned all these functions, and the industry suffered rapid and severe decline. In fact, the U.S. merchant shipbuilding industry in this century has only been economically viable during the two world wars. Unlike other nations that have underwritten merchant ship production with large subsidies, the United States has shown no interest in the viability of the industry beyond the needs of national security. For U.S. shipbuilders, the gulf between boom and bust has been enormous. An analysis of government assumptions and decision making during these conflicts reveals both the economic foundation of this industry and the role of the state in defining it.

In anticipation of both world wars, the U.S. government launched shipbuilding programs through federal agencies created by congressional acts. The timing of the two reveals a significant difference in the nation's reaction to impending peril. The Shipping Act of 1916 was passed only seven months before U.S. involvement in the First World War. As a result, the program had to be worked out during the war itself and reached its peak a full year after the war had ended! In marked contrast, the Merchant Marine Act of 1936 initiated a buildup five years ahead of Pearl Harbor. In the years between 1936 and 1941, the federal government, applying the lessons learned from the First World War, set policy and initiated programs with shipyard owners and workers. When war came, programs were ready and had only to be expanded and accelerated.

The Shipping Act of 7 September 1916 launched this country's World War I shipbuilding program and created the U.S. Shipping Board, a regulatory agency overseeing ship construction. The declaration of war in April 1917 soon forced the Shipping Board to expand and then to divide its authority with the newly created Emergency Fleet Corporation (EFC), which administered the merchant ship construction program.[1] The Emergency Fleet Corporation derived its authority from the expansion of executive power, as President Woodrow Wilson delegated a portion of his new war powers to the EFC in July of 1917.[2]

In the first months of the war, the Emergency Fleet Corporation and the United States Shipping Board faced both organizational and leadership problems that seemed insurmountable. William Denman, chairman of the Shipping Board, and Major General George W. Goethals, head of the EFC, fought over a number of issues, principally the wooden ship program. Both ultimately resigned, and their jobs were consolidated under Edward Hurley in July of 1917. Hurley restructured the organizations to prevent further conflict.[3]

Standardization was key to the rapid revival of the shipbuilding industry in both wars. In each case, the government's demand for tonnage gave the industry the incentive to construct merchant ships on a grand scale. Moreover, the EFC and (during World War II) the U.S. Maritime Commission authorized new yards and designs for standardized ships. Though the extent of standardization was different, new technologies and shipbuilding processes speeded production and training.

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[1] Edward N. Hurley, *The Bridge to France* (Philadelphia: J.B. Lippincott Co., 1927), 24.

[2] W. C. Mattox, *Building the Emergency Fleet* (Cleveland: The Penton Publishing Company, 1920), 6-7.

[3] Hurley, *Bridge to France,* 27-29. For a more recent discussion, see William J. Williams, *The Wilson Administration and the Shipbuilding Crisis of 1917: Steel Ships and Wooden Steamers* (Lewiston, NY: Edwin Mellen Press, 1992).

In his study of World War I entitled *Over Here,* David Kennedy credits Howard E. Coffin, the president of the Society of Automobile Engineers who was appointed to the Naval Consulting Board in 1915, for the push toward standardization in war industries during the First World War.[4] The EFC agreed with Coffin that standardization in shipbuilding would provide the rapid construction needed for wartime. Implementation of such a program was limited, however. First, and most important, the shipways controlled by the EFC contained 137 vessels of 99 different designs for private construction started prior to the war. New construction had to await the completion of those ships. This took time, since each design called for its own hull, propulsion machinery, boiler, rigging, cables, galley outfits, plumbing, and propellers. In addition, naval construction occupied many shipways. The EFC concluded that it would be quicker to build entire new shipyards for the standardized program than to wait for the existing ways to clear.[5]

The second problem confronting the EFC was a steel shortage. Despite the commitment to steel ships, the shortage of steel, the time required to construct new shipyards, and the availability of timber made construction of wooden ships an expedient alternative. The wooden ships had a deadweight tonnage of 3,500 tons and were based on a design for steel ships.

The EFC's internal problems contributed to the failure of this program. In addition, its requirement that all regions use the same ship design, despite local limitations, led to confusion. The standardized wooden ship design worked best on the Pacific coast where the timber was large enough to accommodate it. The Gulf coast timber, on the other hand, proved too small for this design, and the EFC provided no alternative. The dilemma forced the Gulf coast shipyards to import Pacific timber to build to the design's specifications. The Atlantic yards, designed for the construction of smaller wooden vessels, rebelled and simply refused to adopt the new design. The wooden ship program might have had more success if the EFC had permitted standardization of design by region. Although the EFC received widespread criticism for the wooden ship program, it in fact had few options in light of the crisis in metal ship construction. The wooden ship program at least provided some immediate tonnage when it was desperately needed.[6]

The Emergency Fleet Corporation ultimately launched its standardized steel ship program with a design derived from the Submarine Boat Company's construction of wooden submarine chasers for Britain in 1916. The new steel ships had a deadweight tonnage of 5,000 tons. These standardized cargo ships, known during the First World War as "fabricated ships," ultimately provided the EFC with solutions to several pressing problems. First, fabrication speeded construction by standardizing the milling of plates. Second, semi-skilled workers in fabricating shops all over the country could replace skilled shipyard workers, who were in short supply. Third, new shipyard designs speeded the construction of new yards by eliminating many of the established shops and facilities.

The fabricated ship program broke with traditional shipbuilding methods by using outside fabricating shops to produce standardized ship parts. Typically, yards built custom designed ships and manufactured their own parts. This new system allowed shipbuilders to utilize labor and resources nationwide to produce ships. The yards, as conceived by the EFC, would simply erect the hull and install the machinery.[7]

Fabrication also speeded ship construction by simplifying the preparation of steel plates. Traditionally, each rivet and hole in a plate required measuring, marking, and drilling. A standardized design used one set of plans in fabricating shops across the country, permitting the preparation of steel plates prior to shipping. The responsibility for the coordination of the flow of designs and materials between the plants and the shipyards fell upon the Emergency Fleet Corporation.[8]

With fabrication, shipbuilding made its first transition from a specialized industry to mass production. The EFC envisioned shipbuilding ultimately reaching the same level of standardization as the automobile industry. As one observer put it: "The new shipyard was to become the assembling floor of a colossal ship factory, whose machinery was made up of all the interrelated wheels of American industry, whose employees were a large part of the entire body of American labor, and whose conveyor belts were the American railways."[9] In reality, the fabricated shipyards never attained mass-production levels of construction. Yards retained their own mills, plate, and angle shops, while shipping delays frequently forced them to mill their own materials.[10]

The most famous of the three new shipyards built during World War I was Hog Island, located in Philadelphia and managed by the American International Shipbuilding Corporation. The other two yards were located in

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[4] David M. Kennedy, *Over Here: The First World War and American Society* (Oxford: Oxford University Press, 1980), 114.

[5] Mattox, *Building the Emergency Fleet,* 37.

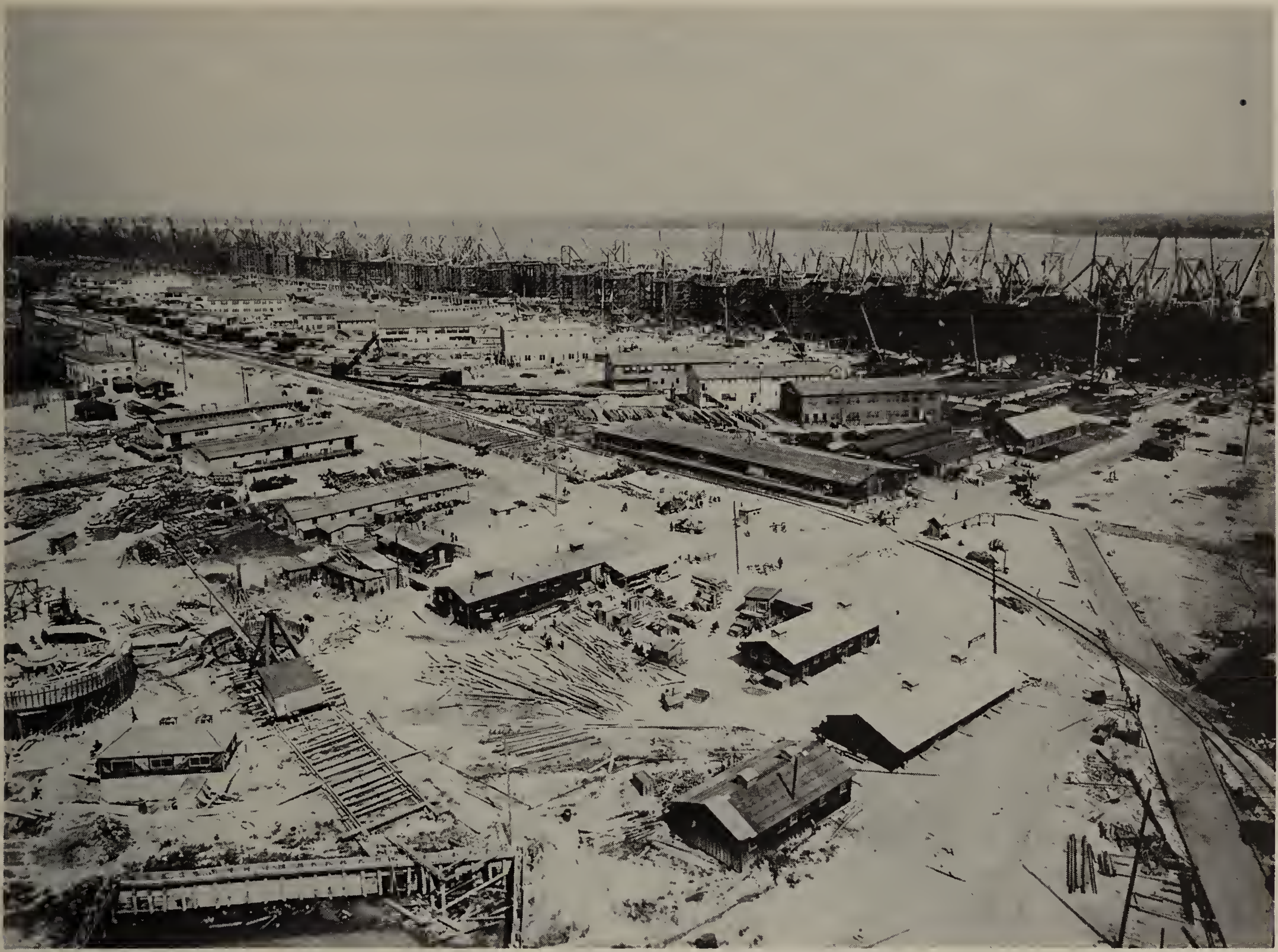
[6] J. Russell Smith, *Influence of the Great War Upon Shipping* (New York: Oxford University Press, 1919), 227-228; Mattox, *Building the Emergency Fleet,* 20, 38; Hurley, *Bridge to France,* 53.

[7] Edward N. Hurley, *The New Merchant Marine* (New York: The Century Company, 1920), 273.

[8] Ibid., 71.

[9] Roy W. Kelly and Frederick J. Allen, *The Shipbuilding Industry* (Boston: Houghton Mifflin Company, 1918), 97.

[10] Smith, *Influence of the Great War Upon Shipping,* 300.



Although its work had been suspended by snow when this photo was taken, the size of the Hog Island shipyard in Philadelphia suggests its pivotal role in World War I ship construction. Photo courtesy of the National Archives, Washington, D.C.

Bristol, Pennsylvania, and Newark, New Jersey. Although the new fabricated ships were built in all three yards, they all became known as "Hog Islanders."

Construction on the Hog Island shipyard began in September of 1917, and the first keels were laid in February of 1918. In April of 1918, a year after America had entered the war, the first Hog Island keels were still on the ways. Several factors contributed to construction delays. First, the unusually cold and snowy winter slowed construction and delayed the shipment of materials. In addition, labor shortages and incomplete facilities further hampered construction. When finally completed, Hog Island was the largest shipyard in the world, with 250 buildings covering 846 acres. The yard contained fifty ways and outfitting docks for another twenty-eight ships. At its peak, Hog Island employed 34,049 workers and built both cargo and troop ships. The total cost for construction of the yard reached $65 million, about double the projected cost. The yard was supplied by eighty-eight fabricating plants and thirty-eight steel mills nationwide. At the height of production, Hog Island laid a keel every five and one-half days.[11]

Despite this dramatic expansion of the shipbuilding industry, the end of the war limited the achievements of the Emergency Fleet Corporation. The shipbuilding program had barely gotten under way when the United States signed the armistice on 11 November 1918, nineteen months after it had declared war. Ironically, EFC's shipbuilding program reached its peak nearly a year after the war ended, and the last ships were delivered in 1921. Of the 1,409 ships built between 1916 and 1921, 1,033 were delivered after the war ended.[12]

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11. Hurley, *Bridge to France,* 86, and *New Merchant Marine,* 75, 80; Smith, *Influence of the Great War Upon Shipping,* 298-299; Mark H. Goldberg, *The "Hog Islanders": The Story of 122 American Ships* (Kings Point, NY: American Merchant Marine Museum, 1991), 11, 12.

12. Mattox, *Building the Emergency Fleet,* 98; Irwin M. Heine, *The U.S. Maritime Industry: In the National Interest* (Washington, D.C.: National Maritime Council, 1980), 117.

Labor shortages during World War I meant that some women, such as these welders, worked in the shipbuilding industry. Photo courtesy of the National Archives, Washington, D.C.

The brevity of the war meant that standardization could never be fully implemented. Although the EFC had intended to revolutionize the industry, it needed far more time to carry out its plans. As one member of the EFC concluded in 1920:

> If the emergency should ever arise again and this country be forced to enter upon a great shipbuilding program, the lessons taught by the war with Germany will emphasize particularly the value of standardization. Conditions made it impossible to apply this theory at the outset, but only the early conclusion of the war prevented carrying the idea into full practice.[13]

Ultimately, the U.S. Maritime Commission remembered these lessons and adapted them to the Liberty ship program of the Second World War.

The depression in the shipbuilding industry prior to World War I had left a shortage of skilled shipyard workers. However, the number of shipyard workers increased from 44,000 prior to the war to a wartime peak of 350,000 workers in the yards themselves and an additional 200,000 workers in the fabricating shops. The new shipyards utilized the skilled workers of related industries to ease the labor shortage. The standardized ship design removed part of the need for broad training in shipyard crafts. However, the new workers were not unskilled; rather, they were bridge builders, structural steel workers, machinists, mechanics, and similarly trained men who adapted their craft skills to shipbuilding. The simplified design had eliminated part of the construction process and the need for some traditional shipbuilding skills, enabling yards to train the new labor force quickly. The reliance on fabricating shops allowed the yards to focus on the assembling of the hulls, a process which still required experience in metal crafts.[14]

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[13] Mattox, *Building the Emergency Fleet,* 137.

[14] Joseph Wright Powell, "Labor in Shipbuilding," in F. G. Fassett, Jr., ed., *The Shipbuilding Business in the United States of America,* 2 vols. (New York: The Society of Naval Architects and Marine Engineers, 1948), 1: 273; Hurley, *New Merchant Marine,* 54-59.

Although one of the most enduring images of World War II is that of "Rosie the Riveter," women were more often employed in welding or, like those pictured above, burning. Photo courtesy of the National Archives, Washington, D.C.

The Emergency Fleet Corporation set up training programs to aid new workers in adapting their skills to shipbuilding. The EFC first trained instructors who in turn trained the new labor force. The first training center opened at the Newport News Shipyard in November 1917, and thirty-five additional centers followed shortly. The centers initially trained 1,098 shipyard mechanics to be instructors. Riveting required the largest number of instructors, followed by other skills unique to shipbuilding such as shipfitting, chipping, and caulking. The yards trained most of the new workers on the job and upgraded many workers from within the shipbuilding industry. According to the EFC, of the 280,000 new shipyard workers, about "half of these men did not need training because of the type of work for which they were needed."[15] By drawing upon skilled metal trades and simplifying the shipbuilding process, the EFC rapidly built a work force in the previously depressed industry.

Women worked in American shipyards during the First World War, although the numbers employed never reached those of World War II. The division of labor between the fabricating shops and the hull assembly process did not permit the substitution of skilled craft labor with unskilled labor. Women, however, were employed in the fabricating plants, which did take advantage of skill dilution.[16] Maurine Greenwald's study of women workers during World War I analyzed the increase in women's employment in all metal trades, including women in shipbuilding fabrication plants. Greenwald concluded that the expansion of the manufacturing sector during World War I "gradually diluted the skilled trades by separating operations into their component parts and assigning single tasks to men and women with no prior training or familiarity with machine operations."[17] Within these metal trades, women operated a variety of machines including lathes, grinders, and both electric and oxyacetylene welding equipment. Locating skill dilution within shipyards during the Second World War permitted yards to utilize women's labor to a greater extent than in the First World War.

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[15] *The Training of Shipyard Workers: Report on the Work of the United States Shipping Board Emergency Fleet Corporation Industrial Relations Division Education and Training Section* (Philadelphia, PA: Emergency Fleet Corporation, 1919), 11, 19.

The Metal Trades Department of the American Federation of Labor (AFL) dominated the shipbuilding industry's organized workers during World War I. At the beginning of the war most yards outside the West Coast had open shops. By 1918, much of the industry, with the exception of southern yards, had unionized.[18] Unions gained recognition as a result of the rapid expansion and the subsequent chaotic conditions in the shipyards. The shortage of skilled labor led management to steal workers from competitors by offering higher wages. To prevent this "scamping" of labor and to settle labor disputes, the Emergency Fleet Corporation set up the Shipbuilding Labor Adjustment Board or Macy Board on 20 August 1917. The Macy Board had representatives from unions, shipyard owners, and government. When it first convened, the board confronted strikes in Seattle, Portland, and San Francisco. In order to settle the strikes and prevent further scamping of labor, the Macy Board set wage rates on a regional basis. By including union representatives, the Macy Board gave the AFL unprecedented strength in the shipbuilding industry.[19] This structure of union, owner, and government cooperation proved to be a successful model for the organizing of labor relations during the Second World War.

Hog Island and the other yards were closed with the end of the wartime programs in 1921. The government considered the three yards a wartime expedient, redundant in peacetime. To be profitable, Hog Island would have had to produce one hundred ships a year, far more than the shipping industry could absorb. In addition, the yards depended on the external fabrication plants and could not exist independently without extensive additions of machinery and shops.[20] Moreover, the surplus of ships from the war construction boom busted the industry throughout the 1920s and 1930s.

The glut of ships profited merchant shippers who purchased them for low prices and thereby offset the high labor costs for American crews.[21] But even at low prices, the majority of ships went unsold. By 1925, all of the wooden ships had been scrapped, and about two-thirds of the steel ships lay rotting in bayous, rivers, and harbors.[22] By the early 1930s, the Great Depression and its impact on international trade further impoverished an industry already in bankruptcy.

Needing to maintain only a core of potential for naval construction and possible future war, the American government made few and only minor efforts to aid the shipbuilding industry in the 1920s. The Merchant Marine Acts of 1920 and 1928 offered some incentives for shipowners to purchase new ships, but for the most part, both acts failed. Private shipyards built a total of twenty-eight ships as a result of the act of 1920 and about forty ships as a result of the act of 1928. Only naval contracts and ship repair work kept the operating yards afloat in the years between the wars.[23]

While the wartime experience demonstrated that America could standardize design and construction, shipyards reverted to custom-building ships in the years that followed and again built only one or two ships of each design. Simply put, standardization required an enormous demand that existed only in wartime. Nevertheless, the Emergency Fleet Corporation did lay the groundwork upon which the U.S. Maritime Commission erected the World War II shipbuilding program.

Before World War II, the American government responded to the turmoil in Europe and the rise of Japan with the Merchant Marine Act of 1936, an effort to reduce the vulnerability of the merchant marine. By 1942, over 90 percent of the 1,422 American merchant ships of 2,000 gross tons or more were over twenty years old (the average life span of a ship) and therefore obsolete.[24] Both President Franklin Roosevelt and Congress supported the new act designed to replace the World War I tonnage and to improve working conditions for the merchant marine. The act provided for an independent agency, the United States Maritime Commission, to oversee the modest ten-year program of fifty ships per year. Joseph P. Kennedy served as the first chairman of the Maritime Commission until 1938; Admiral Emory S. Land and his vice-chairman, Admiral Howard L. Vickery, led the Maritime Commission through the war years. By establishing stable leadership prior to the declaration of war, the Maritime Commission proved significantly more effective than the Shipping Board of World War I.[25]

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16. Mattox, *Building the Emergency Fleet,* 154.

17. Maurine Weiner Greenwald, *Women, War and Work: The Impact of World War I on Women Workers in the United States* (Westport, CT: Greenwood Press, 1980), 6.

18. Powell, "Labor in Shipbuilding," 277.

19. Ibid., 274-275; Smith, *Influence of the Great War Upon Shipping,* 270-271; Mattox, *Building the Emergency Fleet,* 150; Hurley, *Bridge to France,* 186-188.

20. Hurley, *New Merchant Marine,* 81.

21. John G. B. Hutchins, "History and Development of the Shipbuilding Industry in the United States," in Fassett, *Shipbuilding Business in the United States* 1: 55.

22. A. D. Rathbone IV, *Shall We Scrap Our Merchant Marine?* (New York: Robert M. McBride and Company, 1945), 269.

23. Hutchins, "History and Development of the Shipbuilding Industry in the United States," 56; Heine, *In the National Interest,* 119.

24. Rathbone, *Shall We Scrap Our Merchant Marine?,* 273-274.

25. Ibid., 276; M. B. Palmer, *We Fight with Merchant Ships* (Indianapolis, IN: The Bobbs-Merrill Company, 1943), 40; Heine, *In the National Interest,* 9, 121.

Entry into war required a partial reorganization of the U.S. Maritime Commission. Again, as in 1917, authority came from expanded presidential powers under the War Powers Act, passed on 18 December 1941. President Roosevelt created the War Shipping Administration and transferred some of the responsibilities of the Maritime Commission to this new agency. For the most part, however, the Maritime Commission continued to function as it had before the war. In 1942, the Maritime Commission, following the example of the Emergency Fleet Corporation, decentralized its authority into four regions: East Coast, Pacific Coast, Gulf Coast, and Great Lakes. These divisions paralleled those of the Shipbuilding Stabilization Committee that regulated labor relations. After some initial confusion, the new structure proved effective.[26]

By 1936 the depression in shipbuilding had left American yards behind other countries in implementing technological developments. The Maritime Commission intended to utilize innovations such as the turbine engine to make the new merchant marine competitive with those of other nations. The center of the new program was a standardized cargo ship in three designs. Each of the three new C-type designs had a different speed and carrying capacity. The C-type cargo ships were built throughout the war and began the move towards standardization which reached its peak during the war with the emergency ship program.[27]

While the older shipyards benefited first from the new shipbuilding boom, the Maritime Commission rapidly encountered the problem of limited facilities that had beset the Emergency Fleet Corporation in the First World War. By 1939, long-range cargo ships and naval construction filled the existing shipyards to capacity. Like the EFC, the Maritime Commission had to build new shipyards, as well as expand the old ones, to accommodate the increasing demands for tonnage.[28]

As in World War I, German submarine warfare provided the impetus for a new shipbuilding program. In the fall of 1940, German U-boats were sinking ships faster than British shipyards could build them. The British turned to American shipyards to build new cargo ships. Admiral Land, chair of the U.S. Maritime Commission, objected to scarce American resources and ways being diverted to the British program and asked England to contract directly with Todd Shipyards for sixty ships. This program served as the model for the American emergency ship program. The new emergency cargo ship, like the Hog Islander of the First World War, was a wartime expedient, and the Maritime Commission announced in November of 1940 its plans to build two hundred similar ships. As *Newsweek* put it: "To attain speed and economy in construction, strict adherence to uniform design is essential, as our experience with the Hog Island shipyard in World War I proved conclusively."[29] These new emergency cargo ships ultimately bridged the Atlantic and solved the crisis in tonnage for the Allies.

Government intervention in the shipbuilding industry now extended to the locating of new shipyards. With the country only beginning to recover from the Depression, all regions wanted to benefit from new government contracts. The Maritime Commission had to balance New Deal economic recovery with the availability of sites and work forces, and it placed most of its contracts on the Atlantic coast where skilled labor and management were readily available. As the program expanded, the Maritime Commission built yards nationwide. Initially, the commission considered old shipyard sites from the First World War but rejected them because they required extensive renovation and were located in areas already facing shortages of skilled shipyard labor. Eventually, emergency shipyards were located in Portland, Maine; Richmond, California; Portland, Oregon; Seattle, Los Angeles, Houston, New Orleans, and Mobile, as well as several other locations. The South, in particular, was targeted for additional yards because of its labor supply and economic need.

The Maritime Commission rejected plans to construct large shipyards like Hog Island, since they required too great a concentration of labor and materials. However, a large number of small yards also presented a problem, given the limited availability of skilled management. The commission partially resolved this by persuading older shipyards to manage the new emergency yards. Newport News, for example, managed an emergency yard in Wilmington, North Carolina, while Bethlehem provided the management for a new yard in Baltimore. The individual most closely associated with the emergency cargo ships, Henry J. Kaiser, entered the shipbuilding industry through an association with Todd Shipyards. Kaiser was initially included in the partnership because of his contracting background in projects like the Hoover, Bonneville, and Grand Coulee Dams and the Bay Bridge in San Francisco. He had the necessary experience in shipyard construction, and he turned his association with Todd into government contracts for new yards by promoting his shipbuilding managerial experience. Kaiser ultimately held interests in fourteen shipyards.[30]

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[26] Frederick C. Lane, *Ships For Victory: A History of Shipbuilding Under the U.S. Maritime Commission in World War II* (Baltimore, MD: Johns Hopkins University Press, 1951), 139-140, 145-150, 161-162, 171-172.

[27] Ibid., 28-32.

[28] Ibid., 36; *Monthly Labor Review*, March 1941, 571-576; *Time*, 20 May 1940, 73.

[29] L. A. Sawyer and W. H. Mitchell, *The Liberty Ships: The History of the Emergency Type Cargo Ship Construction in the United States During World War II* (Cambridge, MA: Cornell Maritime Press, 1970), 12; Lane, *Ships for Victory*, 42, 81; "Task of Ship Industry Eased by Stress on Standard Design," *Newsweek*, 13 January 1941, 39.

The Maritime Commission used many of the new shipyards to build the emergency cargo ships, dubbed "Liberty ships" to popularize the program. Instead of standardizing by yard, as in World War I, the Commission attempted to use one design nationally. The architectural firm of Gibbs and Cox played a central role in designing the Liberty ship. Prior to the war, William Francis Gibbs anticipated the need for standardized production and had built an organization to meet the needs of shipbuilders in the coming emergency. The Liberty ships were 10,000 deadweight tons and used reciprocating steam engines. The lack of turbines for the Liberty ships limited their potential speed to eleven knots, which would make them uncompetitive in a postwar market. Like the fabricated ships of World War I, the Liberty ships were seen as a wartime expedient to maximize tonnage on the ocean.[31]

Ultimately, a combination of welding and prefabrication won the battle for tonnage in World War II. Throughout 1942, the number of ships built and the number lost to sinkings remained about even. By 1943, however, the United States was clearly winning the battle for tonnage. The shipbuilding programs for 1942 and 1943 not only met the Maritime Commission's most optimistic goal of twenty-four million tons but exceeded that goal by three million tons. The yards met these production goals despite the fact that many were still under construction or were producing their first and slowest round of ships. The Liberty ships used mass production techniques with the greatest success. However, shipyards turned out Liberty ships in the hundreds, not the thousands, so it could more accurately be termed "multiple production." Since shipyards were limited to constructing hundreds rather than thousands, they found it impractical to invest in the machine tools and dies which would have made shipbuilding more closely resemble the automobile industry to which it was frequently compared. Nonetheless, the Liberty ship program brought the U.S. shipbuilding industry closer to mass production than it has ever been, either before or after the war.[32]

All-welded ship construction materially speeded up ship production during World War II and became one of the greatest innovations within the shipbuilding industry. Although welded ships had been built prior to the war, the lack of demand in the shipbuilding industry inhibited use of the new process. To maximize use of the new technology, older shipyards needed to reorganize to reflect new production flow designs. During the Depression, shipbuilders simply had neither the demand nor the capital necessary for this venture.

The British insistence on welded construction in their American-built ships led American shipbuilders to recognize the advantages of welded over riveted ships. Immediately, welded construction aided the American shipbuilding program in two ways: first, shipyard facilities were constructed more swiftly, and second, shipyard workers could be trained more swiftly.[33] All-welded construction also saved steel by eliminating the need for overlapping plates. This also decreased the weight of the ships and

Henry J. Kaiser, the individual most associated with the standardized emergency shipbuilding program of World War II, is shown above demonstrating the use of prefabricated subassemblies on a ship model. The photograph on the right shows such methods of standardization put into practice at a West Coast shipyard. Photo above courtesy of the National Archives; photo at right courtesy of the Library of Congress, Washington, D.C.

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[30] Lane, *Ships for Victory*, 48-55.

[31] Ibid., 72-88.

[32] Ibid., 202, 205; "Building Liberty Ships," *The Welding Engineer*, March 1942, 85; "Mass Built Ships," *Business Week*, 7 March 1942, 9.

[33] "Transactions of the Institute of Welding, London, England," October 1942, File 204.1.1, Records of the U.S. Maritime Commission, Box 30, Record Group 178, National Archives, Washington, D.C. (hereafter RG 178, NA).

increased their cargo carrying capacity.[34] Ultimately, however, welding had its greatest impact on the recruitment of shipyard labor. As one article put it, ". . . it is much easier to train good welders than good riveters. Females can and do weld, but they cannot rivet. The average man would prefer to weld rather than rivet."[35] Welding combined with prefabrication speeded up the construction process, since welding could then be done in the downhand position, which was the easiest method to learn.[36] When women entered the shipbuilding industry, they became concentrated in welding.

The shipyards of the Second World War differed from the Hog Island shipyards of the first in the area of fabrication. In World War I, shipyards like Hog Island served primarily as assembly points for the prefabricated sections which were hauled to the yards from outside steel and fabricating plants. The Maritime Commission intended to follow this pattern in World War II, but it found that steel plants were unwilling to undertake this additional burden. As a result, shipyards were forced to do their own "prefabrication" on the premises in shops designed for that purpose. Shipyards built and stored subassemblies so that once the keel was laid, the ship could be assembled quickly and moved off the way. The speed of downhand welding also aided the preassembly process.[37]

Like the Emergency Fleet Corporation, the Maritime Commission also contracted with shipyards for construction. Abuses and profiteering in shipbuilding during the First World War under the cost-plus system led to a new variation which called for a fixed, variable fee with maximums and minimums. Under this arrangement, the higher the cost of construction, the lower the fee paid to the contractor. This new cost-plus system also differed from competitive bidding and lump-sum payment contracts used by the Maritime Commission prior to the war. The new emergency shipyards also called for a different form of contracts. The Maritime Commission objected to government ownership of the new yards since it might be construed as socialism. However, the commission also knew that the emergency shipyards would have little or no postwar value since they did not contain all the traditional equipment of the older yards. In addition, remembering the postwar shipbuilding depression after the First World War, the Maritime Commission anticipated a similar oversupply of tonnage following World War II. The emergency yards were ultimately owned by the government but run by private companies. The Maritime Commission also contracted for the Liberty ships on a slightly different basis using a cost-plus fee based on the number of man-hours. The man-hour contracts reflected the idea that the speed of construction would increase as shipyards became more efficient and organized. The contracts also reflected the emphasis on speed and expediency in the construction of Liberty ships.[38]

America's entry into the Second World War in December of 1941 led to the expansion and intensification of the shipbuilding programs implemented prior to the war. Several new shipyards were built and others were expanded; however, shortages of materials, especially machinery and steel, became a major bottleneck in production. Ultimately, further expansion of facilities became impractical because the materials could not be provided to construct the ships. In addition, a lack of trained managerial personnel and skilled shipyard workers also inhibited the construction of new facilities. The Maritime Commission instead focused on increasing the productivity of existing facilities.

By 1940, national magazines again carried articles highlighting possible shortages of skilled shipyard workers. During the Depression years, workers had left the shipbuilding industry for more profitable fields of employment. Shortages of naval draftsmen, welders, riveters, and machinists were noted in 1940, after total employment in thirty-three shipyards passed 50,000 for the first time in over twenty years.[39] By March of 1941, the government was predicting serious shortages of welders, machinists, shipfitters, sheet-metal workers, and electricians. As in the First World War, a government report recommended drawing upon skilled workers from other industries, such as construction, to meet the labor demands. The report went on to state:

> The shipbuilding industry will be faced with a tremendous problem in obtaining the necessary skilled workers. This need will undoubtedly be met in part by "upgrading" and by adaptation of existing skills. However, the major part of the labor force will have to be recruited from the outside. The shortage of available skilled workers in this industry is such that most of the new workers will require careful selection and extensive training before they can be utilized effectively in the shipbuilding program.[40]

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[34] "Steel Conservation," 5 July 1941, File "Steel 1941," Box 35, RG 178, NA.

[35] "The British Merchant Shipbuilding Programme in North America, 1940-1942," *Shipbuilding and Shipping Record,* 7 January 1943, 15.

[36] A. W. Carmichael, *Practical Ship Production,* 2d ed. (New York: McGraw Hill, 1941), 204-209, 229.

[37] Lane, *Ships for Victory,* 206-210, 213-214; Hutchins, "History and Development of the Shipbuilding Industry in the United States," 59.

[38] Lane, *Ships for Victory,* 101-109; R. Earle Anderson, "United States Maritime Commission Procedure," in Fassett, *Shipbuilding Business in the United States* 2: 23-24, 31.

[39] "Navy Orders Mean More Shipyards," *Business Week,* 27 July 1940, 17-18.

[40] "Labor Requirements for Shipbuilding Industry Under Defense Program," *Monthly Labor Review,* March 1941, 571-576.

As the shipbuilding industry expanded and competed for skilled workers, the Maritime Commission feared a return to the labor unrest that had occurred at the beginning of World War I. The EFC's experience with shipbuilding stabilization through the Macy Board encouraged the Maritime Commission to address the problems of labor shortages and unrest prior to America's entry into the war. With labor shortages already occurring by 1940, the government feared that shipyards would steal skilled workers from each other, increasing labor costs and disrupting both shipyards and local communities.

By the late 1930s, three different unions operated in the shipbuilding industry. The Metal Trades Department of the International Brotherhood of Boilermakers, the Iron Ship Builders, and the Helpers of America, affiliated with the American Federation of Labor, had survived the postwar depression but in a weakened condition. In many older shipyards on the East Coast, owners had instituted Employee Representation Plans, or company unions. This led to the founding in 1936 of the Industrial Union of Marine and Shipbuilding Workers of America (IUMSWA), an industrial union affiliated with the Congress of Industrial Organizations. The IUMSWA won several major strikes in Atlantic coast shipyards, but others, such as Newport News, maintained company unions throughout the war.[41]

On 27 November 1940, Sidney Hillman, the commissioner in charge of the Labor Division of the National Defense Advisory Commission, announced the formation of the Shipbuilding Stabilization Committee, composed of representatives from unions, the shipbuilding industry, the navy, the Maritime Commission, and the National Defense Advisory Commission. The committee's purpose was to stabilize labor conditions in the shipbuilding industry. The issues addressed fell into eight categories: wages, overtime, shift premiums, limits on production, strikes or lockouts, training, and duration of agreements. The committee decided to settle these issues by zones and held conferences in four regions: the East Coast, the Pacific, the Gulf, and the Great Lakes. Since the cost of living differed among zones, the committee applied regional standards. The union which predominated in each region represented labor at the conferences; thus, the AFL represented the West Coast and the Great Lakes, the IUMSWA represented the East Coast, and they shared representation in the Gulf region. The Shipbuilding Stabilization Agreements were put into effect for two years.[42]

In 1937, the shipbuilding industry had asserted that "shipbuilding cannot be pursued in accordance with modern precision-controlled methods of assembly line production because each ship is a distinctive creation, a custom-built product." For this reason, "one prerequisite of the shipyard worker is his willingness to take pains. Experience is a most valued attribute, which accounts for the lengthy service of many shipyard employees."[43] These skilled craftsmen differed radically from the shipyard workers of the 1940s, many of whom had never seen an ocean vessel or even an ocean. The recruitment and maintenance of a stable work force regardless of previous experience occupied both shipyard owners and the Maritime Commission during World War II.

Employment in shipbuilding hit a low in 1933 of 56,100 workers. By Pearl Harbor, employment had climbed to 556,000 and peaked in November of 1943 at 1,399,000 workers employed in private shipyards.[44] Recruitment of a work force followed a distinct pattern in most shipyards during World War II. The yards relied upon a small core of skilled men who had worked in the shipbuilding industry prior to the war. As yards expanded, they drew workers from related trades into the labor force. Unlike the First World War, when this additional labor force proved sufficient, the continued expansion of the industry and decreasing availability of skilled workers forced the World War II shipyards to recruit from other manufacturing industries and then from non-manufacturing industries. At first, yards recruited workers from local areas, later from elsewhere in the state, and eventually from out of state. Shipyards hired white men first, then white women and black men, and eventually black women as well as other minorities.[45] As large numbers of new workers entered the shipyards, the unions, communities, and other traditional sources of stability became strained. Like the Emergency Fleet Corporation in World War I, the Maritime Commission also had the ultimate responsibility for negotiating solutions to these new problems.

As labor shortages intensified, labor recruitment became a more serious problem. Initially, the yards relied on the unions and the United States Employment Services to refer workers. As this pool of workers diminished, yards began to employ more aggressive recruitment tactics. The responsibility for regulating labor nationwide fell to the War Manpower Commission, which worked with the Maritime Commission to set employment ceilings in shipyards located in areas of labor shortages. A major problem for recruiters was the shortage of housing and transportation in many of the shipyard boomtowns.[46]

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[41] IUMSWA Education Department, *This is IUMSWA* (Education Department, Industrial Union of Marine and Shipbuilding Workers of America-CIO), 49, Wagner Archives, Tamiment Library, New York University.

[42] Office of Production Management, Labor Division, *Ships for Freedom: The Story of the Stabilization Program in the Shipbuilding Industry* (Washington, D.C., 1941), File 295.3.1, Box 32, RG 178, NA.

[43] National Council of American Shipbuilders, *Commercial Shipyards and the Navy* (New York: National Council of American Shipbuilders, 1937), 31.

[44] "Employment in the Shipbuilding Industry 1935-1943," *Monthly Labor Review*, May 1944, 940-950.

[45] "Sources of Labor Supply in West Coast Shipyards and Aircraft-Parts Plants," *Monthly Labor Review*, November 1942, 928, 931.

The unions played a crucial role in both the recruitment of new workers and the breakdown of crafts into skill-diluted tasks. Both the Boilermakers and the IUMSWA aided the shipyards in the dilution of skills and helped organize new training programs for unskilled workers. They did so for a number of reasons. First, the unions could not afford to alienate the government or the public by opposing maximum production during a war. While they had traditionally opposed skill dilution, the unions recognized that breaking down the crafts to employ unskilled workers increased production. Second, the newly hired shipyard workers greatly increased union membership. The Boilermakers, for example, received closed-shop agreements in many West Coast yards. Third, job titles and wage rates continued despite the breakdown of the craft skills. Although new workers joined the shipyards with reduced skills, they did not threaten the old workers' wage rates, since they were paid the full amount of the craft rate despite their lack of skills.

The recognition of unions by both government and management through the Shipbuilding Stabilization Committees also added to their security. The unions realized that the war had given them an opportunity to gain strength and chose to grant concessions to shipyard owners in return for recognition and benefits. Individual workers did not suffer from the skill dilution, since the experienced shipyard workers became supervisors or leadermen in the expanded or new shipyards. Unions made sure that contracts included seniority clauses, since they too remembered the postwar decline after World War I.[47]

The Maritime Commission, believing that "the greatest possible amount of all training time should be on actual production," had little interest in workers learning a craft. Moreover, it saw no need to train workers beyond the immediate needs of the yard, calling it "wasteful in both time and material to train a welder in three positions when that welder will do nothing but tacking."[48] The training in skills rather than in an entire craft reached the point that the grounds for advancement in a craft became based almost solely on the length of time of employment. The yards both paid and promoted workers along traditional craft lines, regardless of whether they had been trained in limited skills or the entire craft. While this training in tasks provided an immediate work force during the war, the new workers were left unemployable during reconversion when the industry reverted to a strict craft basis.

By 1944, the United States had won the battle for tonnage, and the shipbuilding program shifted toward the construction of a faster, more efficient postwar merchant marine. The Maritime Commission switched its emphasis from Liberty ships to faster Victory ships. In addition, the government gave shipyards contracts for a variety of landing craft and other specialized warships. Even before the war ended, the shipbuilding industry began the process of reconversion, and employment in the yards began to drop. After the war, yards closed and shipbuilding in the United States reverted back to the small, craft-based industry of the prewar era.

By 1943, the Maritime Commission had already moved away from the standardization embodied in the Liberty ship. Since steel remained in short supply, the Commission decided to use its allotment to built the faster Victory ships. In addition, turbines had finally become available and the expediency of using reciprocating steam engines was no longer necessary. The navy also wanted faster cargo ships that could keep up with the convoys across the Atlantic, while shippers wanted vessels that could compete in the postwar market. The Victory ship carried the same 10,000 deadweight tons of the Liberty ship but could travel at fifteen knots instead of eleven.[49]

The switch to Victory ships was only one aspect of the reconversion process. Before the war had ended, the government, unions, and management had all begun to address the question of the postwar period. The experience of industry following World War I led many to believe that shipbuilding would again enter a decline after the war; others feared that the country would return to the depressed conditions of the 1930s. To steer clear of these shoals, each group advanced proposals for piloting the industry during reconversion.

Henry J. Kaiser asserted in an address on 6 December 1942 that the country and government should already be planning for the postwar period. The primary needs of the country, according to Kaiser, would be housing, transportation, highways, and essential medical care. He worried that the country would return to a depression unless it invested in these necessary items. In the postwar years, Kaiser himself invested in automobile construction and continued to be active in health care services, which he had begun in his shipyards.[50]

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[46] "California Shipbuilding Corporation," January 1944, 2, File C, Records of the U.S. Maritime Commission, Entry 88, Box 436, RG 178, Washington National Records Center, Suitland, MD (hereafter WNRC).

[47] *Master Agreement Covering New Ship Construction between Pacific Coast Shipbuilders and the Metal Trades Dept., AFL* (Seattle: AFL, 23 April 1941); Pacific Coast Zone Shipbuilding Stabilization Conference, "Minutes of Labor's Working Committee," 12 July-26 August 1943, 3; "Men for Defense Work," *Shipyard Worker,* 27 September 1940, 8; "Resolutions Adopted at IUMSWA National Conference," *Shipyard Worker,* 17 April 1942.

[48] Memorandum, J. Wolff to D.S. Ring, "Shipyard Training in North Carolina Shipbuilding Co.," File "North Carolina," Entry 93, Box 482, RG 178, WNRC; Letter, Wolff to Ring, "Training Survey Trip in Maritime Shipyards," 29 January 1943, File 205-1-5, Box 31, RG 178, NA.

[49] Lane, *Ships for Victory,* 574-577.

Unions also voiced concern over the postwar shipbuilding industry. The IUMSWA proposed a plan at its 1944 convention that endorsed the principle of free trade and urged strengthening and modernizing the navy. It also recommended retraining semi-skilled war workers as full craft workers. Liberty ships, said the IUMSWA, should not be sold at prices which would undercut new ship construction and instead should be lent or leased to war-ravaged countries. Recalling the World War I experience, the report stated, almost prophetically, "there can be no more rows of vessels rotting on the rivers of America, ghost shipyards and ghost towns."[51]

The Women's Advisory Committee of the War Manpower Commission and the Women's Bureau also addressed the issue of women's roles in the postwar economy. The number of women in the shipbuilding industry had peaked in November of 1944 at 11.5 percent of all workers in private shipyards. However, owners took advantage of returning veterans and rapidly began to replace women workers with men. The minutes of a WAC meeting in 1943 demonstrate the concern that the end of the war would replicate the experience of World War I for women. One member asked: "Have they discussed at all what they are going to do with these many thousands of women who are going, supposedly, to drop out the minute the war is over? . . . They wouldn't drop out last time." Another member stated that "it was months and months before the women were taken on, and their seniority rights were absolutely disregarded." A third concluded that the policy statement on seniority by the WMC was "formulated particularly by a group of men, they had no thought of women in here . . . it was all men and the seniority of men. They always forget the women, and they think well, they will be out, anyway."[52] While a number of proposals were made by different organizations like the WAC, in fact little was done. Despite surveys to the contrary, both the government and employers preferred to believe that women would quietly return to their homes after the war.

Despite all proposals to the contrary, the end of the Second World War paralleled that of the first. The shipbuilding industry entered a decline from which it has never recovered. The government canceled contracts, shipyards closed, and workers had to seek employment elsewhere. The Labor Market Surveys of Hampton Roads, Virginia, reflected the problems of shipyard workers nationwide. Workers who had learned skills and commanded high wages during the war refused employment at the lower wages offered by employers. Employers took advantage of the labor surplus to require more rigid job specifications. The number of women employed continued to decrease, and the returning veterans began to seek employment. By October of 1945, some women had ceased to look for new employment, while other workers found that the skills they had acquired during the war, were not "acceptable to present employer specifications." According to the U.S. Employment Services, after a year workers had accepted the changes in the job market and had taken jobs at lower pay and skill levels. The surplus of labor gave employers the advantage of being able to dictate the terms of employment.[53]

During the postwar reconversion, the government relinquished its control over the shipbuilding industry. Its policy of intervention only for the duration became clear as employers regained control of the industry. In a report by the Surplus Administration in January of 1946, the Maritime Commission argued that shipyard workers trained during the war in emergency yards would have no place in the postwar shipbuilding industry, stating that:

> Many of the emergency yards were designed as mass-production facilities for assembly-line output of a limited number of types of ships, and therefore did not need a large staff of workers experienced in design, such as the old yards had. Their greatest need was for workers trained in one or two repetitive operations rather than for trained shipbuilders. . . . A large portion of workers in the yards building fighting ships had a need for skill and past experience not necessary in building of merchant ships. . . . These workers will in large measure provide the permanent skilled-labor force in the shipbuilding industry.[54]

In addition, the report declared that the unskilled men and women who had worked in the shipbuilding industry during the war could transfer their new skills into employment in other industries. It went on to state the government's position on the disposal of surplus shipyards, indicating that emergency yards would not be retained as they could not be adapted to the anticipated postwar construction. Emergency yards, like the fabrication yards of the First World War, would be closed in the postwar

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50. Henry J. Kaiser, "Management Looks at the Post-War World," address to the 1943 meeting of the National Association of Manufacturers, copy at Bancroft Library, University of California, Berkeley, CA.

51. *Report of Proceedings of 10th National Convention,* IUMSWA-CIO, 28 September - 4 October 1944, p. 175, Series 4, Subseries 1, Box 1, IUMSWA Papers, University of Maryland, College Park, MD.

52. Verbatim Minutes, Meeting of Women's Advisory Committee, 14 April 1943, U.S. War Manpower Commission Records, Series 31, Box I-6, Record Group 211, National Archives, Washington, D.C.

53. United States Employment Services, "Labor Market Developments Report for Hampton Roads, Virginia," September 1945, Labor Market Survey Reports, U.S. Employment Service Records, Box "San Francisco," Record Group 183, National Archives, Washington, D.C.; ibid., October 1945; ibid., July 1946.

54. "Shipyards and Facilities, Report of the Surplus Administration to Congress," 31 July 1946, 11-12, File 211, Box 39, RG 178, NA.

period. The navy decided once again to depend on old, established shipyards that, with their expanded facilities, could meet the limited demand for ships. The government feared that retaining the emergency yards could "result in undue hardship to the old yards to the detriment of the country's best interests." The report concluded that these older yards had provided the nucleus of expertise for the World War II program and could be depended upon to do so in the future, if necessary.[55]

A report on war preparedness by the Maritime Commission in 1949 set the minimum number of employees necessary for the shipbuilding industry at 50,000 production workers. In addition, the report stated that in future emergencies provisions would again be made for "in-plant feeding, transportation, housing, first-aid and medical treatment; and utilization of women." It concluded that since women had proved so adaptable to certain crafts, provisions should be made in future for child care.[56] The report also confirmed that the Maritime Commission believed the World War II shipbuilding program had been successful and could become a blueprint for future emergencies. As the First World War had served as the example for the second, so would the second provide a model for future wars. While the experience of an extended war and shipbuilding program provided a longer trial and error period during World War II, the Maritime Commission saved both materials and time by building on the experience of the Emergency Fleet Corporation.

Despite the hopes of unions and the industry during the war, a surplus of ships again remained an obstacle to new postwar construction. Although the Liberty ships had been intended as emergency vessels with a five-year life expectancy, some remained in use through the 1960s. As a result, the shipbuilding industry revisited the decline of the 1920s and 1930s. By the 1970s only ten major private shipyards remained in operation, and more recently, several more have closed. Some industry analysts believe that the inability of the American shipbuilding industry to compete internationally was inevitable. One has argued:

> America's tragedy in shipbuilding is that, unlike most of the other things she manufactures, ships cannot be mass-produced in peacetime. . . . American shipbuilding, therefore, must inevitably remain in times of peace a custom-built organization in a mass-production nation; an industry which, with few special exceptions, is unable to build for export purposes.[57]

The experience of the Japanese shipbuilding industry, however, belies this truth. Japan led the international shipbuilding market after the 1950s. A combination of mass-production technology and low labor costs made Japan competitive in the industry. Ironically, the rehabilitation of Japanese shipbuilding after World War II resulted from American capital, engineering, and production planning. Japan effectively utilized the welding and prefabrication techniques developed by the United States during the war. While the Japanese shipbuilding industry became increasingly capital intensive, the American industry returned to its labor-intensive production methods. The shipyards which remain in operation in the United States are primarily those which existed prior to World War II (or even World War I), and whose layout predate welding and modern subassembly techniques.[58]

If an expansion of the United States shipbuilding industry again became necessary, new yards and sites would again have to be found. The increase in value of waterfront property in the 1980s has led former shipyard sites to be covered with condominiums in many cities. Ironically, some former shipyard sites in Baltimore are now covered with debarking imported Japanese cars. It seems unlikely that American naval or merchant ship construction will ever again reach its World War II heights. As the recent Gulf War underscored, aircraft now play the predominant role in both warfare and transportation. The end of the Cold War continues to diminish the need for a strong navy, further undermining the American shipbuilding industry. The shipbuilding industry, however, is only one of the many heavy industries in the United States in decline. The government's policy of intervention in wartime and *laissez-faire* in peacetime continues to leave its mark on other industries as well.

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55. Ibid., 14.

56. E. J. Tracy, "Shipyard Employment," 9 December 1949, Attachment, Shipyard Labor, General Part 25, 1 August 1949, File 508-1, U.S. Maritime Commission Records, U.S. Maritime Commission, Washington, D.C.; ibid., Part 24, 13 July 1949.

57. A. C. Hardy and Edward Tyrrell, *Shipbuilding: Background to a Great Industry* (London: Sir Issac Pitman and Sons, 1964), 143.

58. Koh Araki and Masaaki Kanayama, "Chronological Summaries of Shipbuilding Practice in a Japanese Shipyard," in *Welding in Shipbuilding: A Symposium* (London: Institute of Welding, 1962); William F. Beazer, William A. Cox, and Curtis A. Harvey, *U.S. Shipbuilding in the 1970s* (Lexington, MA: Lexington Books, 1972), 15.

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Oak Trees and Balance Sheets:
James Davidson, Great Lakes Shipbuilder and Entrepreneur

JOHN O. JENSEN

On 26 July 1900, a thunderous splash cut through the sooty industrial air of West Bay City, Michigan. Captain James Davidson, lately the hero of the lumber industry and occasional thorn in the side of Great Lakes shipping moguls, had launched yet another of his oaken goliaths. The *Pretoria,* marine papers on both sides of the Atlantic announced, was the longest and largest capacity schooner ever built. While the marine reporters discussed how the ship was built, knowledgeable Great Lakes observers were asking themselves a much different question. Why did Davidson, with his thirty-year career as a respected independent shipbuilder and successful shipping company owner, continue to build these outmoded and unwanted wooden behemoths? Steel, the other major Great Lakes builders had long realized, was the best material for modern ships. Size alone said enough. At 338 feet long, the *Pretoria* might be the longest wooden vessel afloat, but she was a runt compared to the five-hundred-foot-long steel lakers now coming out of the yards. Why then did Davidson continue to build with wood? An examination of the background and shipbuilding career of Captain Davidson, the last major wooden shipbuilder on the Great Lakes, will begin to answer that question.

Between 1870 and 1903 James Davidson built the largest wooden ships on the Great Lakes, including some of the longest ever intended for deepwater navigation. Since he built his largest ships well after steel had supplanted wood in Great Lakes vessel construction, Davidson's achievements were largely forgotten well before his death in 1929. Many of his contemporaries viewed him as a radical and later as an anachronism, but neither label holds up under close scrutiny. A progressive and sometimes daring shipbuilder, James Davidson was first and foremost a shrewd and imaginative businessman. This commercial orientation, itself a product of temperament and deliberate training, led him to continue building wooden ships at a time when all other builders of his stature had either moved on to steel or retired.

Built to take advantage of existing and anticipated economic conditions, the Davidson vessels were successful social and technological achievements. His ships made money, both as examples of the cutting edge of Great Lakes marine architecture, as they were in the 1870s and 1880s, or as the curiosities they became at the beginning of the twentieth century. Although overshadowed in history by the construction of steel vessels on the Great Lakes and by huge wooden six-masted schooners on the Atlantic coast, Davidson's later vessels should be remembered as the best and most technologically advanced wooden ships produced in the United States during the late nineteenth and early twentieth century.

THE MAKING OF A MARITIME ENTREPRENEUR

James Davidson was born of Scottish parents in or near Buffalo, New York in 1841. His father, Joseph Davidson, was a stone contractor who won a government contract to build the first stone piers in Buffalo's harbor.[1] Buffalo in the 1840s and 1850s was a vibrant, fast-growing city. The completion of the Erie Canal in 1825 had made it the most important port on the Great Lakes. A vital link between the cities of the eastern seaboard and the land and natural resources of the northwestern frontier,

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[1] J. B. Mansfield, *History of the Great Lakes,* 2 vols. (Chicago: J.H. Beers, 1899; Cleveland: Freshwater Press, 1972), 1: 973. All subsequent citations are to volume one. The life of James Davidson, while not shrouded in mystery, is not well known. He apparently left no autobiography or diaries, and the records of his shipyard were destroyed in the 1950s. Ralph K. Roberts, 1992 correspondence with the author, materials on file at the State Historical Society of Wisconsin, Historic Preservation Division, Madison, Wisconsin (hereafter referenced as Roberts, personal communication).

Captain James Davidson. Photo courtesy of C. Patrick Labadie, Canal Park Marine Museum, Duluth, Minnesota.

Buffalo was a center of trade and industry. It was also an important departure point for westward travelers. On a single day in 1838, for example, an estimated 5,000 people departed from Buffalo for points west.[2] Thousands more stayed in the gateway city, and its population, which was about 18,000 in 1840, expanded sixfold by 1860.[3]

Commercial growth accompanied the Old Northwest's expanding population. During the 1840s, the economic value of Great Lakes commerce grew at an average rate of 18 percent per year. This rapidly developing commerce required growing numbers of ships. In 1841, six or eight ships provided sufficient tonnage to handle traffic between Buffalo and Chicago. Only five years later, the trade was supporting, according to one estimate, fifteen paddle steamers, twenty propellers, and uncounted sailing craft. In 1851 over 9,000 vessel clearances and arrivals were recorded for the port of Buffalo — up from about 2,000 just twenty years before.[4] Not only were more ships on the lakes; some of them were of a size and splendor nearly unequaled in the world.

Buffalo produced some of the grandest Great Lakes vessels of the mid-nineteenth century. Preeminent among the city's builders was the yard of Bidwell and Banta, whose many fine steamers, such as the *Niagara* and *Lady Elgin,* reflected the firm's illustrious pedigree. Benjamin Bidwell, as the apprentice and later partner of Asa Stannard, had connections to the earliest days of commercial ship construction on Lake Erie. Among their other accomplishments, Stannard and Bidwell played an instrumental role in the construction of the famed steamboat *Walk In The Water,* the first of the lower lakes steamers to navigate Lakes Erie, Huron, and Michigan. Jacob Banta, designer of huge sidewheel steamers during the 1840s and 1850s and, according to a prominent early lake captain, "a genius of high order," had been apprenticed while quite young to New York City shipbuilder Henry Eckford. One of the most important builders of his time, Eckford indirectly influenced American shipbuilding for several generations. His successors designed and built the great sailing ships — both packets and clippers — that allowed the United States to dominate oceanic carrying trade until the Civil War.[5] It was at Bidwell and Banta that James Davidson began his shipbuilding career.[6]

American literature is replete with romantic accounts of young men going from rags to riches through imagination, education, and diligence. This stereotype has its basis in fact, and the life of James Davidson, while not exactly beginning in rags, is a genuine example of the great American success story. According to J. B. Mansfield's *History of the Great Lakes,* when Davidson's parents died in 1852, he "of necessity . . . became self-supporting," and established a ferry across the river at Buffalo.[7] In a version told by another historian, the young orphan built a rowboat and carried sailors out to ships anchored in the harbor.[8] Davidson began his lake sailing and shipbuilding career as a young teenager but continued to attend Buffalo public schools during the winter. Hundreds of small sailing craft ranged the lakes during the 1850s, and he moved into positions of responsibility early, becoming a second mate at age seventeen and a master at nineteen.[9] As small schooners required little crew, Davidson's early advancement is impressive but probably not unusual.

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[2] Edward Channing and Marion Florence Lansing, *The Story of the Great Lakes* (New York: Macmillan, 1909), 267.

[3] Pamela Wilson Reeves, "Navigation on Lake Erie, 1825-1860," chap. 3, part 1, *Inland Seas* 14 (1958): 257.

[4] Reeves, "Navigation on Lake Erie," chap. 3, part 1, *Inland Seas* 15 (1959): 308-310.

[5] Augustus Walker, "Early Days on the Lakes, With an Account of the Cholera Visitations of 1832," *Publications of the Buffalo Historical Society* (Buffalo: Buffalo Historical Society, 1902), 292, 315; Robert G. Albion, *Square-Riggers on Schedule: The New York Sailing Packets to England, France, and the Cotton Ports* (Princeton, NJ: Princeton University Press, 1938; Archon Books, 1965), 83-85.

[6] Roberts, personal communication.

[7] Mansfield, *History of the Great Lakes*, 973.

[8] Walter Havighurst, *The Long Ships Passing: The Story of the Great Lakes* (New York: Macmillan, 1975), 262.

After public schooling, Davidson enrolled at Bryant and Stratton's Mercantile College in Buffalo. An expanding enterprise, Bryant and Stratton's had branches in Buffalo, Albany, Cleveland, and Chicago; all four were thriving cities stocked with ambitious young men. The school's curriculum suggests that Davidson's early aspirations ran far beyond the command of a schooner. In 1857, the college charged forty dollars — at the time between two and three months' pay for a lake sailor — for its full course, which included "all Departments of Bookkeeping, Lectures, Commercial Calculations and Practical Penmanship." Along with technical courses in writing, penmanship, and accounting, the college offered lectures in commercial law and ethics, banking, finance, and political economy — the broader tools of business that would eventually reshape the American economy during the Gilded Age.[10]

Bryant and Stratton's offered far more than just instruction; it offered explicit opportunities for hungry young men. The school's advertisements carefully noted that through "the extensive business acquaintance of the Principals, many of the students, on graduating, are placed in lucrative positions." Lest prospective students question just what business connections Bryant and Stratton's had, their advertisements prominently displayed a forty-eight-name honor roll of American financial and political enterprise. These were the school's "Directors," and while their positions were probably honorary, their association with the college seemed to promise students good jobs and bright futures. The name of at least one of the Directors, C.M. Reed, surely caught Davidson's eye. The "Napoleon of the Lakes," Reed, a millionaire several times over, had made a fortune in transportation and for many years controlled the Great Lakes' largest fleet of passenger steamers.[11] The length of Davidson's tenure at the Mercantile College is undetermined, but as the fees covered unlimited instruction with no time limits until graduation, he may have attended over a period of years during the winter months when ice closed lake navigation.

As James Davidson reached his late teen years, the optimism and opportunity which had characterized Buffalo and lake commerce from the time of his birth began to crumble. In 1857 the completion of railroad links across the upper midwest region and a nationwide financial panic caused the bottom to fall out of Great Lakes shipping. Freight and passenger rates fell. By September of that year, some steamboat lines were losing $1,000 per day.[12] Despite the fact that seamen's wages had fallen to between $15 and $20 per month, many of the large and lavish sidewheel steamers were taken out of service forever.[13] Requiring over two hundred acres of forest per year just for fuel, the mammoth "palace steamers" could not survive in an era of falling transportation rates.[14]

Conditions for the sailing fleet were little better, with commercial opportunities so scarce that some vessel owners risked their ships on dangerous voyages from the lakes to the ports of Europe. In 1858, at least fifteen ships left the lakes on international quests for profit, with sixteen more following the next year.[15] The lake exodus continued in 1860 when thirty-nine lake craft left for the ocean.[16] Some owners simply gave up rather than take such excessive risks. In 1858, the Lake Navigation Company found few takers when it offered sixty-one sailing vessels for sale at prices reflecting less than half of their recent values.[17]

The downturn in the Great Lakes maritime economy, while deep and slow to reverse, was not universal. Shipbuilding continued at reduced levels, although the vessels launched were generally smaller than in previous years.[18] The amount of bulk grain products shipped on the lakes continued to increase. Between 1853 and 1860 the volume of wheat and wheat flour shipped out of Lake Erie and Lake Michigan ports expanded by nearly 150 percent. The largest increases came during the otherwise lean years of 1857 to 1860. Railroads could not compete with the cross-lake transportation of bulk products, and a profit margin remained for those with proper ships.[19] This continued to be the case as the nineteenth century progressed, and it had profound effects on the design of lake vessels.

It is difficult to determine how the economic transformations of the late 1850s specifically affected Davidson, but his prospects must have seemed uncertain. With lake sailors' wages down and shipbuilding in a lull, the expansion of the grain trade would have provided meager consolation to an ambitious young man beating the docks. With civil war in the air, the economic future of the United States itself was cloudy.

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[9] Mansfield, *History of the Great Lakes*, 973.

[10] *Buffalo City Directory* (Buffalo: E.R. Jewitt, 1857), 47.

[11] Ibid.

[12] Pamela Wilson Reeves, "Navigation on Lake Erie, 1825-1860," chap. 3, part 2, *Inland Seas* 16 (1960): 29.

[13] Ralph G. Plumb, "The 1857 Depression on the Lakes," *Inland Seas* 10 (1954): 290.

[14] *Niles National Register*, 20 December 1848; Mentor L. Williams, "Horace Greeley Tours the Great Lakes in 1847," *Inland Seas* 3 (1947): 137-141.

[15] Mansfield, *History of the Great Lakes*, 677-679.

[16] Ibid., 191.

[17] Plumb, "The 1857 Depression on the Lakes," 291.

[18] Mansfield, *History of the Great Lakes*, 677-79.

[19] John G. Clark, *The Grain Trade in the Old Northwest* (Urbana, IL: University of Illinois Press, 1966), 280-88.

James Davidson's views on slavery and the war are unknown, but while thousands marched and died, he followed the sailor's life. In January 1862, Davidson married Ellen Rogers of Buffalo and soon after left for the Atlantic Ocean, taking a job with the famous Black Ball Line of sailing packets.[20] The great sailing packets long enjoyed a deserved reputation of shipping before their masts some of the Atlantic Ocean's most skilled and toughened crews. Iron-fisted captains, whose major source of income depended upon meeting the Line's schedule, drove both men and ships hard. By 1862, however, the North Atlantic packet lines were on the decline, and as revenues fell, the packet companies cut costs by hiring smaller, lower quality crews. Shipboard brutality was rife, with gangs like the "Bloody Forties" (a vicious Liverpool sailors' brotherhood) terrorizing fellow crewmen, passengers, and officers. On the "Old Line," as it was known, survival of the fittest was the rule.[22]

Despite declining standards, Davidson undoubtedly learned much during his Atlantic service. The ships he served in were among the best wooden sailing vessels afloat. Appreciably larger than lake sailing vessels of the time, the packets, heavily built of the finest materials, were designed for year-round trade in the rough North Atlantic. Emphasizing capacity more than speed, ocean packet designs featured, like later lake schooners and steamers, flat floors and relatively long straight runs.[23] During Davidson's tenure, the Black Ball Line owned ten ships, all built between 1843 and 1855 by William H. Webb of New York. Webb, the most prolific American shipbuilder in terms of tonnage prior to 1860, owned the old Henry Eckford yard where Davidson's former employer Jacob Banta had learned his craft. Webb probably even worked alongside Banta after Webb's father succeeded Eckford in 1824.[24]

While some accounts state that Davidson's travels took him as far as Russia and India, England probably interested the future engineer and capitalist most of all. The Black Ball Line sailed a regular schedule between New York and Liverpool. Home to the greatest maritime facilities of the mid-nineteenth century, Liverpool was maritime enterprise on a different scale. Its well-engineered and logically arranged docks with their swing bridges and adjacent fireproof warehouses contrasted sharply with the rickety wooden grain elevators that lined Buffalo Creek. During the late 1840s, when the arrival of a few dozen vessels swamped Buffalo's harbor facilities, Liverpool could efficiently handle several times that number. It may be no coincidence that the Saginaw River slips of Davidson's later West Bay City yard resembled Liverpool's carefully arranged Mersey River harbors.[25]

In 1864 freight rates improved appreciably on the lakes. Sensing renewed opportunities, or perhaps just tiring of the long absences that ocean service entailed, Davidson returned to Buffalo and business studies. The return was well timed; lake commerce continued to revive and Davidson — now a mature mariner of broad experience — sailed as master during the profitable 1865 season.[26] New vessel construction followed the economic revival, and that winter Davidson resumed his shipbuilding career, probably with the Mason and Bidwell yard, successors to Bidwell and Banta. Continuing to advance, in 1866 Davidson went to Toledo, Ohio as superintendent of the prolific Bailey Brother's shipyard.[27]

During the late 1860s Davidson invested his growing earnings in sailing craft, including the little scow-schooner *Sea Gull*, a low-cost enterprise which he operated with one other man and a boy cook.[28] He also invested in at least two larger ships during this period.[29] These early enterprises and investments were successful, and shortly after his first child was born in the winter of 1867, Davidson — or rather Captain Davidson as the Buffalo City Directory now listed him — moved his family into the home they would occupy for many profitable years.[30] As the decade of the 1870s approached, Captain James Davidson, shipbuilder, mariner, and entrepreneur, was set to become an important figure on the Great Lakes.

TRANSITIONAL TIMES

The 1870s heralded a golden age on the Great Lakes. As sectional wounds healed, a reinvigorated country turned its attention to industrial and continental expansion. The Great Lakes region was an important supplier and consumer of grain, timber, and iron — the raw materials of national development. Most of these bulk commodities were transported via the lakes, usually on schooners.

The lakes network stretched from Duluth, Minnesota to the Atlantic, but physical barriers impaired its efficiency as an industrial waterway. Early canals and shallow channels limited vessel size. All ships engaged in east-west trade from Buffalo to the ports of Lake Michigan had to pass through channels like the St. Clair Flats near Detroit. In 1866, the Flats' narrow and shifting channel rarely offered more than twelve feet of water. Principal lake harbors with controlling depths of nine to fifteen or sixteen feet, often less when lake levels were down, were no better.[31]

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[20] Mansfield, *History of the Great Lakes*, 973; Havighurst, *The Long Ships Passing*, 262.

[21] Albion, *Square-Riggers on Schedule*, 151.

[22] Ibid.; Melvin Maddocks, *The Atlantic Crossing* (Alexandria: Time-Life Books, 1981), 87-90.

[23] Maddocks, *The Atlantic Crossing*, 77-195.

[24] Ibid., 83-85.

[25] Ibid., 106-111.

[26] Mansfield, *History of the Great Lakes*, 973.

[27] Ibid., 698, 973; Havighurst, *The Long Ships Passing*, 262; Roberts, personal communication.

[28] H.C. Inches and Chester J. Partlow, "Great Lakes Driftwood: Schooner Scows," *Inland Seas* 20 (1964): 294.

[29] Havighurst, *The Long Ships Passing*, 262.

[30] *Buffalo City Directory* (Buffalo: Thomas, Howard, and Johnson, 1868); Havighurst, *The Long Ships Passing*, 262.

Despite barriers to navigation and an expanding railroad network, bulk commodities could be moved long distances more cheaply over water than across the land. Of the many types of steam and sailing craft that had evolved to fill niches in the lake marine economy, one, the schooner, dominated much of the nineteenth century. From before the War of 1812, lake schooners, most (after the mid-1840s) with retractable centerboards and all with relatively shallow drafts and labor-efficient fore-and-aft gaff-rigged sails, offered the best value in bulk commodity transportation.

The schooner survived as a commercial vessel type because it could easily adapt to meet new economic conditions. As lake commerce grew in volume, schooner dimensions and cargo capacities increased as well. The developing lakes grain trade provides an example. In the early 1840s, prior to the development of improved unloading methods, an average schooner delivering to Buffalo might carry 4,000 bushels of wheat. In the winter of 1842-1843, Buffalo's first mechanical unloader/grain elevator was built. Capable of moving 15,000 bushels per day, the elevator reduced unloading times from days to hours.[32] With the unloading roadblock alleviated, schooner cargo capacities rapidly doubled and tripled. Soon general-purpose craft like the 218-ton *Alvin Clark*, built in 1846, and the 186-ton *Meridian*, built in 1848, were carrying 10,000 or more bushels of wheat.

Schooner size continued to increase somewhat between the late 1840s and the Civil War. For example, the 246-ton *Lydia Case*, a schooner built in 1862 in Manitowoc, Wisconsin for the grain trade, and considered large for her day and place, carried 14,000 bushels of wheat.[33] Larger capacity square-rigged sailing vessels were also built but did not prove as efficient as schooners either in terms of sailing qualities or cost of operation.

As the 1860s drew to a close, schooners were making money. Taking advantage of the thriving economy, Captain James Davidson entered the shipbuilding business as an independent builder and in 1870 built his first schooner. Launched from the Bailey Brothers yard in Toledo, the 269-gross-ton *Laura Belle* carried three masts and was 138 feet in length, 26 feet in breadth, and 11 feet in depth of hold.[34]

In 1871 Davidson built his second vessel, the *E. M. Davidson*, on rented ground along the Saginaw River near the town of Wenona (later West Bay City), Michigan. Except for a slightly higher gross tonnage, the *E. M. Davidson* was essentially a twin to the *Laura Belle*.[35] In terms of technology, these schooners were simple to build and did not require extensive yard facilities. The primary costs were for labor and materials. Davidson's son wrote of early schooner construction on the Saginaw River:

> It was customary in those days for a person building a ship to lease a plot of ground on the Saginaw River, build the ship, launch it, and that completed the operation. The ships in those days were built entirely by hand. The timbers were hoisted on high saw horses and then, with one man standing on top and another beneath the timbers, they were sawn into frames, planking, ceiling and deck beams.[36]

For Davidson, building these schooners represented a considerable investment in time and money. But the risk was low and short-term; during the early 1870s the demand for schooners like the *Laura Belle* and the *E.M. Davidson*, each valued at about $20,000, was brisk.[37]

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[31] Jerome K. Laurent, "Trade, Transport and Technology: The American Great Lakes, 1866-1910," *Journal of Transport History* 4 (1983): 21-22.

[32] David J. Cooper, *1986-1987 Archaeological Survey of the Schooner* Fleetwing *Site, 47-DR-168, Garrett Bay, Wisconsin*, East Carolina University Research Report No. 6 (Greenville, NC: East Carolina University), 42.

[33] David J. Cooper and John O. Jensen, "Survey of Submerged Cultural Resources: Selected Sites in Lakes Michigan and Superior: A Report on the 1991 Field Season" (Unpublished report on file, Division of Historic Preservation, State Historical Society of Wisconsin, 1992), 21.

[34] Board of Lake Underwriters (BLU), *Lake Vessel Register, System of Classification* (Buffalo: Board of Lake Underwriters, 1874), 15; Bureau of Navigation, *List of Merchant Vessels of the United States* [MVUS] (Washington, D.C.: Government Printing Office, 1885); Catherine C. Baker, *Shipbuilding on the Saginaw* (Bay City, MI: Museum of the Great Lakes, 1973), 19-20; C. Patrick Labadie, 1992-93 correspondence with the author, materials on file at the State Historical Society of Wisconsin, Historic Preservation Division, Madison, Wisconsin (hereafter referenced as Labadie, personal communication). One source, a sketch written by James E. Davidson (Captain Davidson's eldest son and partner) shortly before his death in the late 1940s states that the *Laura Bell* was built in West Bay City, Michigan. Stronger evidence says Toledo. Davidson had some arrangement with Bailey Brothers involving the schooner's construction, as federal shipping lists and the Board of Lake Underwriters documents show them, rather than Davidson, as the *Laura Belle*'s builder.

[35] BLU, *Lake Vessel Register*, 31; James E. Davidson, *Early Shipbuilding in the Saginaw Valley* (manuscript provided by Ralph K. Roberts, on file, Division of Historic Preservation, State Historical Society of Wisconsin, 1948), 1; Baker, *Shipbuilding on the Saginaw*, 19.

[36] Davidson, *Early Shipbuilding in the Saginaw Valley*, 1.

[37] BLU, *Lake Vessel Register;* Knut Gjerset, *Norwegian Sailors on the Great Lakes: A Study in the History of American Inland Transportation* (Northfield, MN: The Norwegian-American Historical Association, 1928), 15.

The activities of other builders across the lakes paralleled Davidson's. Thirty-two schooners were launched in 1879, thirty-four in 1871, and forty-five in 1872. As output increased, an important change was occurring: schooner size was increasing dramatically. According to the 1874 listings of the Board of Lake Underwriters, the mean size for schooners built in 1870 was 243 gross tons. By 1872 that statistic had climbed to 408 tons, a 68 per cent increase.[38] The jump in tonnage, which held constant for vessels launched in 1873 and 1874, reflected both the profitability of lake commerce and, more importantly, improvements to navigation — particularly the 1871 opening of the St. Clair Flats Canal. The new canal provided a guaranteed thirteen feet of water and a wide channel, thus alleviating what had been the most serious impediment to interlake navigation for decades.[39]

Davidson's next project reflected the improved waterways. On leased land in Saginaw, Michigan, he built a 733-gross-ton schooner that measured 202.5 feet in length, 34.8 feet in breadth, and 13.3 feet depth of hold. This enterprise quickly paid off when the leading vessel owners on the lakes, the Winslows of Buffalo and Cleveland, purchased the ship. The *Kate Winslow* was believed by some to be the largest sailing vessel on the lakes at the time of her construction in 1872. In terms of gross tonnage, however, she ranked only third among five schooners built in 1872 that exceeded seven hundred tons.[40] Dimensions for the other craft are not currently available, but Davidson's big schooner may well have been the longest sailing vessel on the lakes when launched. As a point of comparison, the schooner *Lucerne,* built at Tonawanda in 1873 and also owned by the Winslows, measured only six gross tons less than the *Kate Winslow* yet was 7.5 feet shorter, 1.1 feet narrower, and, to the detriment of shallow-water navigation, was six inches deeper in depth of hold.[41]

The new class of schooners initially proved popular and profitable. In 1873 at least fourteen more were launched around the lakes; Davidson, however, had turned his attention to other, more revolutionary developments occurring in lake marine architecture.

In 1869, Captain Elihu Peck launched the *R. J. Hackett,* generally regarded as the prototype for the modern Great Lakes bulk carrier. One of the most innovative vessels in Great Lakes history, the *R. J. Hackett*'s pilot house was built at the extreme forward end of the ship. A potentially dangerous feature for ocean vessels commonly exposed to high seas, it afforded lake vessels superior visibility for maneuvering in tight channels and congested harbors. Propulsion machinery was placed aft, eliminating excessively long and vulnerable propeller shafts and the need for potentially inaccessible and, in terms of capacity, wasteful shaft alleys running through the hold. Designed for bulk cargoes, the ship's hatches were built on twenty-four-foot centers that mated with the twelve-foot spacing of the gravity-fed loading chutes of the Marquette iron ore docks. All of these features became standard in later generations of lake carriers.[42]

The size of the *R. J. Hackett* was limited by the same geographical factors that limited schooner dimensions. At 210 feet in length and 1,129 gross tons, she was certainly a large ship but no giant when compared to contemporary passenger steamers. This limited size, however, was partially surmounted by another innovation: the installation of a powerful engine that allowed the ship to tow a consort of two loaded barges of sizes equal to the *Hackett* herself. Although expensive, forty-seven of the double-decked bulk carriers were built between 1869 and 1874.[43]

James Davidson evidently realized a good profit from the sale of the *Kate Winslow.* In 1873 he bought a plot of land along the Saginaw River near Wenona and began building a large steam vessel similar to the *R.J. Hackett.* Named the *James Davidson,* the bulk carrier departed significantly from Davidson's first three schooners both in design and mode of construction. The *James Davidson* was among the first ships to be built on the lakes at a yard using a sawmill. This early attempt to industrialize production was, according to the builder's son, less than successful; the Muley sawmill wasted timber and drove up construction costs. It burned near the end of the project and was not replaced.[44]

Dark financial circumstances surrounded the *James Davidson* when it slid sideways into the Saginaw River in 1874. The national depression touched off by the September 1873 failure of Jay Cooke and Company had not yet fully embraced the lakes, but ship buyers were scarce. The high profits of recent years had resulted in an overproduction of lake craft, saturating the market. In addition, the economic depression had reduced available investment capital, leaving few people able or willing to pay the

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[38] These figures are derived from the 1874 Board of Lake Underwriters vessel list and offer a comparison of relative activity during this period rather than firm numbers. Other schooners were built but not included on the list.

[39] Mansfield, *History of the Great Lakes,* 253.

[40] BLU, *Lake Vessel Register;* Davidson, *Early Shipbuilding in the Saginaw Valley,* 1.

[41] David J. Cooper, ed., *By Fire, Storm and Ice: Underwater Investigations in the Apostle Islands,* Office of the State Archaeologist, Technical Publication No. 1 (Madison, WI: State Historical Society of Wisconsin, 1991), 31.

[42] Mark L. Thompson, *Steamboats and Sailors of the Great Lakes* (Detroit, MI: Wayne State University Press, 1991), 33-34.

[43] Daniel J. Lenihan, ed., *Submerged Cultural Resource Study: Isle Royale National Park,* Southwest Cultural Resources Center Professional Papers No. 6 (Santa Fe, 1987), 57-58.

[44] Davidson, *Early Shipbuilding in the Saginaw Valley,* 2.

$80,000 to $100,000 or more James Davidson would have required for the bulk carrier.[45] Rather than sell at a loss, Davidson operated the ship himself — a practice he continued to follow in later decades.

The mid-1870s were difficult years for shipowners. In 1874, when the *James Davidson* entered service, freight rates had already fallen moderately from recent levels. Severe declines followed, with the average rate for Chicago wheat delivered in Buffalo plummeting from 11.46 cents per bushel in 1873 to under 3 cents in 1876. Similar declines occurred in coal, lumber, and iron ore rates. Sailors' wages, a good indicator of economic vitality, dropped to between $1.25 and $1.50 per day — about one-third what they had recently received.[46]

Lake traffic fell with the rates. Overall tonnage shipped declined in 1874, 1875, and 1876, most notably in the volume of industrial commodities, iron ore and coal, carried on the lakes.[47] Lake commerce observers, like the editors of Chicago's Norwegian newspaper the *Skandinaven,* blamed the hard times upon persistent railway rate wars that artificially depressed freight tariffs and pulled traffic from the lakes. In 1876, the *Skandinaven,* whose sympathies lay with the many Norwegian schoonermen, noted that the railroads were making so little profit that the rates must soon rise and "much of the freight will again be carried by lake vessels, and better days will again dawn for the vessel owners."[48]

Better days indeed dawned, just as the *Skandinaven* predicted. Lake traffic picked up in 1877 and some large shipowners reported healthy profits.[49] The recovery continued in 1878 when a record 8,780,700 tons of cargo were shipped on the lakes. By 1880, the annual total rose to 11,940,900 tons — nearly 50 per cent greater than in the bumper year of 1873.[50]

The total value of goods shipped, however, did not rebound as quickly. In 1873, an estimated $187,700,000 worth of goods were shipped on the lakes. This figure was not exceeded until 1880.[51] Lake commerce, in terms of the kinds and relative amounts of cargo carried, although fluctuating from year to year, did not change during this period, but the value of each ton of cargo carried declined.

Statistics of two virtually identical years (according to the distribution of principal cargo types) illustrate the devaluation of lake cargo. The first occurred two years before the panic, while the second was a year of economic recovery and relative prosperity on the lakes. In 1871, grain accounted for 35.5 percent of cargo tonnage, timber 34.7 percent, iron ore 13.1 percent, and coal 13.3 percent. In 1878 the figures were grain 36.0 percent, timber 32.9 percent, iron ore 14.4 percent, and coal 13.9 percent. In 1871, the mean value per ton of Great Lakes cargo was $23.13; in 1878 that figure was $17.01 — a loss of $6.12 per ton.[52] The drop in the value of Great Lakes cargo after the Panic of 1873 may partially reflect the deflationary pressures of an extended national depression, but it also signified a permanent downward adjustment in shipping rates on the Great Lakes. While rates stabilized and increased during periods of prosperity, the overall trend was downward.

Independent schooners could not operate profitably under the new conditions. In 1874 a congressional report estimated that the cost, including an acceptable profit margin, of moving a bushel of Chicago wheat to Buffalo in the largest and most efficient class of schooners, was 4.13 cents.[53] When the average rate exceeded ten cents, as it often had in previous years, such operational expenses were more than acceptable; but when the rate fell below three cents as it did by 1876, it equaled disaster. By deferring maintenance, declining all but unavoidable tows, and reducing wages, some independent schooners cut expenses to very low levels and persisted as marginal operations.[54] The day of the schooner as the first-line lake carrier, however, was over.

Schooners paid better, however, when cut down into schooner-barges and towed in groups of up to six behind tugs or powerful bulk carriers like the *James Davidson.*[55] In 1873, at the height of schooner prosperity, James Davidson had, through luck or design, anticipated the coming economic conditions when he chose to build a steam bulk carrier rather than another large schooner. This decision and his business skills allowed Davidson to survive during the depressed years of the mid-1870s.

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[45] John L. Harnsberger, *Jay Cooke and Minnesota: The Formative Years of the Northern Pacific Railroad, 1869-1973* (New York: Arno Press, 1981), 321; Irving S. Kull and Nell M. Kull, *An Encyclopedia of American History in Chronological Order* (New York: Eagle Books, 1965), 345.

[46] Gjerset, *Norwegian Sailors on the Great Lakes,* 87-89; James D. Rae, "Great Lakes Commodity Trade, 1850-1900" (Ph.D. diss., Purdue University, 1967), 256; John Myron McCarty, "Economic Aspects in the Evolution of the Great Lakes Freighter" (Ph.D. diss., University of South Carolina, 1971), 142-143; Mansfield, *History of the Great Lakes,* 535.

[47] Samuel H. Williamson, "The Growth of the Great Lakes as a Major Transportation Resource, 1870-1911" in *Research in Economic History: An Annual Compilation of Research,* vol. 2 (Greenwich: JAI Press, 1977), 188-89.

[48] Gjerset, *Norwegian Sailors on the Great Lakes,* 94.

[49] Mansfield, *History of the Great Lakes,* 732.

[50] Williamson, "The Growth of the Great Lakes as a Major Transportation Resource, 1870-1911," 188-89.

[51] Ibid., 188-89.

[52] Ibid.

[53] Laurent, "Trade, Transport and Technology," 11.

[54] Oscar B. Smith, "The Schooner *La Petite,*" *Inland Seas* 26 (1970): 198-214, 223-228.

[55] Gjerset, *Norwegian Sailors on the Great Lakes,* 96-97; Cooper, *Archaeological Survey of the Schooner* Fleetwing, 44-46.

Economic turnaround came in earnest in 1879, with average grain rates from Chicago to Buffalo rebounding to 4.74 cents per bushel and lumber rates from outposts like Manistee and Menominee going up about 25 percent.[56] The upward trend continued in 1880. For James Davidson, who had adapted to the lower freight rates, profit must have been high and the future bright. Looking toward a promising new decade and recognizing the economic realities governing Great Lakes shipping, Captain Davidson returned to the shipbuilding business.

DAVIDSON SHIPBUILDING

Between 1881 and 1903, James Davidson's West Bay City shipyard produced dozens of large wooden steamers and schooners or schooner-barges. The financial success of Davidson's shipbuilding, transportation, and milling enterprises reflected both the evolving demands of lake commerce and the shipyard's proximity to the lumber-related industries of the Saginaw River area of Michigan. Located adjacent to some of Michigan's finest stands of white pine, the Saginaw River, beginning in the 1850s, attracted the attention of eastern lumbermen. The huge pines, up to 175 feet tall and seven feet in diameter, were not the only trees in the surrounding forests. A large variety of soft and hard woods also abounded, including oak — the shipbuilder's material of choice. Because of this location Davidson enjoyed, during his yard's most productive years, low material costs relative to the rest of the country, a high degree of industrialization, a well-skilled but low-waged work force, and a central industry, lumber, which supported a large volume of lake traffic.[57]

West Bay City began as the town of Wenona and was the creation of lumber baron Henry Sage. In 1863 Sage purchased 116 acres of land on the west side of the Saginaw River, across from Bay City. Within two years he had in operation one of the largest, most modern, and most efficient sawmills in the lakes region. Along with the mill, Sage and his partners put nearly a million dollars into the carefully planned company town. By 1868, Wenona had a population of 1,200 and contained "all the conveniences of city life." When Davidson first came to Wenona in 1871, the town, economically and socially, was a pocket of civilization on an edge of the forest. This bucolic environment quickly eroded, however, and by 1875 over 120 mills reflecting dozens of industries, mostly lumber-related, were operating along a twenty-five-mile stretch of the Saginaw River. In 1877 Wenona united with two neighboring communities to form West Bay City. By 1880, the two Bay Cities had thriving economies and a combined population of 27,040.[58]

The West Bay City of 1880 little resembled the Wenona of 1871, and shipbuilding in the region had changed as well. For Davidson, the era of picking a likely spot along the river bank and going to work was over. Producing and repairing modern lake vessels at competitive prices required an extensively equipped yard and expensive tools. In 1880 Davidson built a large graving dock, three hundred feet long, forty-five feet wide at the gate, with thirteen feet of water over the sill, that could accommodate any lake vessel then in existence. He also purchased the fixtures of the defunct Ballentine and Moore Shipyard and moved them to his plant at the foot of Randolf Street in West Bay City.[59]

As large-scale shipbuilding resumed on the Great Lakes, the quest for more efficient vessels continued. Despite the proven efficiency of the *R. J. Hackett*-style bulk carriers, some prospective ship owners and builders still preferred large schooners. In 1881 Toledo's Bailey Brothers yard, James Davidson's former employers, launched the first five-masted schooner in United States merchant marine history. The magnificent *David Dows* was 265 feet in length, 37 feet in breadth, 18 feet in depth of hold, and had masts stretching 150 feet into the sky. Built at the contract price of $78,000, the *David Dows* bankrupted the Bailey Brothers yard.[60] In 1883, after a multi-year struggle, Ohio builder Valentine Fries launched the giant 278-foot schooner *Golden Age*. Well before the ship's completion, an apparently disillusioned Fries told government agent Henry Hall that if he ever built again, it would be in iron. The *David Dows,* the *Golden Age,* and a number of smaller contemporaries soon ended up on tow lines as schooner-barges.[61]

Valentine Fries' proposed shift to iron may have been prompted by the concurrent activities of some fellow Ohioans. In 1882 the Globe Ship Building Company and a consortium of Cleveland investors launched the lakes' first iron bulk carrier. The *Onoko,* the largest ship on the lakes at 287 feet in length, 38.8 feet in breadth, and 20.7

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[56] Mansfield, *History of the Great Lakes,* 523.

[57] Jeremy W. Kilar, *Michigan's Lumbertowns: Lumbermen and Laborers in Saginaw, Bay City and Muskegon, 1870-1905* (Detroit: Wayne State University Press, 1990), 21-22.

[58] Ibid., 42-44, 55, 82, 84, 101.

[59] Davidson, *Early Shipbuilding in the Saginaw Valley,* 1; Roberts, personal communication.

[60] Henry Hall, *Report on the Shipbuilding Industry of the United States,* Tenth Census, vol. 8 (Washington D.C.: Government Printing Office, 1884), 140; Bureau of Navigation, *List of Merchant Vessels of the United States,* 1885; Kenneth R. Dickson, "The Longest Schooner (1881) in the World," *Inland Seas* 42 (1986): 2-6.

[61] Hall, *Report on the Shipbuilding Industry of the United States,* 140; Donald Wood, "A Morning with Valentine Fries, Shipbuilder," *Inland Seas* 41 (1985): 172-174; Dickson, "The Longest Schooner in the World," 8-9.

feet in depth of hold, had a cargo capacity that remained unmatched for many years.[62]

Vessel design and cost were more important factors than hull material during most of the 1880s. Wood was still cheaper than iron or steel and required far less investment in yard equipment and labor. Furthermore, size limits for wooden bulk carriers had yet to be reached. These facts defined Davidson Shipbuilding's economic niche during its most productive years.

In a precursor to later developments, a council of lake shipbuilders met in Buffalo, New York in 1874 to draw up new rules for the standardization and construction of Great Lakes vessels. Captain E. P. Dorr, the council chairman, noted that improvements to the Welland and Lower Canals would soon allow the largest lake vessels to trade upon the oceans. Writing at a time when America's saltwater shipbuilders were failing to compete internationally, Dorr noted that future lake vessels must equal any in the world in quality and innovation if Great Lakes shipbuilding were to survive.[63] When shipbuilding on the lakes resumed in 1880, some builders, including James Davidson, prepared to take Dorr's advice.

In November 1880 Henry Hall, a special agent for the federal government, began a study of the United States shipbuilding industry. Hall personally visited and collected data from shipyards on the Atlantic and Pacific coasts, the Mississippi river, and the Great Lakes.[64] On 25 and 26 August 1881, Hall visited the Saginaw River shipyards and was impressed. In his massive 1884 census report, Hall noted that the "finest ship-yards for wooden shipbuilding in the United States are on the Saginaw river."[65] Of particular merit was the "remarkably handsome" shipyard of F. W. Wheeler.[66]

Connected to the forests by railroads, Wheeler's yard was highly mechanized and well tooled. Rough logs were delivered directly to the yard and handled exclusively by steam machinery until their final placement as ship timbers. The efficiency was such that the "stick never changes end, and no steps are wasted in handling it." Hall was told that mechanization had cut in half the amount of human labor required. While Wheeler's yard was the best of the four main Saginaw river yards, all of them systematically applied steam power to ship construction.[67] As for the future, Wheeler informed Hall that he expected to be building for ocean trade when the Canadian locks opened on the St. Lawrence River.[68]

Wheeler may have surpassed Davidson in yard efficiency in 1881, but not in shipbuilding. While Henry Hall devoted only two complimentary sentences in his notebook to a four-masted propeller, the *Clyde*, then on Wheeler's stocks, he devoted over a page of closely detailed notes to James Davidson's *Oceanica.*[69] Built at a cost of about $125,000, *Oceanica,* as her name implied, was designed with salt-water service in mind. The hull was strapped and heavily belted around the top with iron and could pack 2,000 tons of cargo on fourteen feet of water, leaving, according to Hall's figures, nearly ten feet of freeboard.[70]

Some of the *Oceanica*'s technical merits are clear when contrasted with an older bulk carrier *V. H. Ketchum.* When Great Lakes shipbuilding abruptly stopped in 1874, the 233-foot long, 1,660-gross-ton *V. H. Ketchum* was considered the largest vessel on the lakes. Her 23-foot depth of hold, when heavily loaded, drew too much water to permit navigation through major channels or most lake harbors.[71] *Oceanica* measured 1,490 gross tons and, at 263 feet, was 30 feet longer than the *V. H. Ketchum.* Her depth of hold, however, was only 19 feet — a considerable advantage at a time when the controlling depths of major connecting waterways were only fifteen or sixteen feet.[72] *Oceanica*'s design was clearly in keeping with Davidson's earlier practice of building ships capable of carrying more cargo on less water than comparable vessels by other builders.

Between 1881 and 1884, the Davidson yard launched one large bulk carrier each year. The 272-foot *Siberia* came in 1882, the 263-foot *George T. Hope* in 1883, and the 282-foot *Australasia* in 1884.[73] While retaining the same basic shape, Davidson made significant changes to each new vessel. For example, where the *Oceanica* had five hatches, the *George T. Hope* had seven.[74]

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[62] Bureau of Navigation, *List of Merchant Vessels of the United States,* 1885; Richard J. Wright, *Freshwater Whales: A History of the American Shipbuilding Company and Its Predecessors* (Kent, OH: Kent State University Press, 1969), 24.

[63] David J. Cooper, "Synthesizing the Archaeological and Historical Record of Great Lakes Maritime Transportation" (Paper presented at the Annual Conference on Historical and Underwater Archaeology, Kansas City, MO, 1993), 3-4.

[64] Hall, *Report on the Shipbuilding Industry of the United States,* v.

[65] Ibid., 172.

[66] Henry Hall, "Ship Building in the United States," (1881 notebook on file in the Penobscot Marine Museum, Searsport, ME), 75.

[67] Hall, *Report on the Shipbuilding Industry of the United States,* 172.

[68] Hall, "Ship Building in the United States," 76.

[69] Ibid., 76-77.

[70] Ibid., 77; Hall, *Report on the Shipbuilding Industry of the United States,* 173. Despite the early optimism, large canals to the ocean did not develop in the time frame anticipated and no Davidson vessels ever made it to salt water.

[71] Havighurst, *The Long Ships Passing,* 221-222.

[72] Bureau of Navigation, *List of Merchant Vessels of the United States,* 1885; Laurent, "Trade, Transport, and Technology," 21.

[73] Bureau of Navigation, *List of Merchant Vessels of the United States,* 1885.

[74] *West Bay City Evening Press,* 13 July 1883.

The launch of the schooner-barge *Pretoria* at West Bay City, Michigan, 26 July 1900. Photo courtesy of Ralph K. Roberts.

When the *Australasia* was on the stocks, Captain Davidson took a newspaper reporter on a guided inspection through the ship, which was said to be the largest vessel on the lakes in terms of physical dimensions and second only to the *Onoko* in carrying capacity. Iron belts three-quarters of an inch thick and ten inches wide ran fore and aft along the outer hull and on the inside of the frames and were strongly joined by iron fastenings. The outside belt was also attached to iron cross-braces which ran along the inside of the hull down to the turn of the bilge.[75] In addition to the iron strapping, Captain Davidson explained that he was introducing a new idea in the way of trusses:

> [O]ne . . . will be placed in the center, about one-fourth way from the stem, another amid-ships and the third about one-fourth way from the stern. The fourth will be placed just forward of the boilers. A heavy truss will begin on either side at the bilge and proceed to the center of the upper deck, and thence to the main keelson. The truss first alluded to will be two and one-half inches in diameter, and will be firmly fastened at top and bottom with nut and washer set up tightly. The braces, from bilge to center, will be secured, screwed by a turn buckle. The first trusses are each calculated to support a 150-ton strain, and those beginning at the bilge, seventy-five tons.[76]

As a final measure, an iron arch extended from the fantail forward, completing "a perfect network of iron bands around the boat, imparting great strength and firmness." Costing approximately $140,000, the *Australasia*'s carrying capacity was estimated at about 2,600 tons.[77]

Davidson sold the *Oceanica* upon completion but kept the *Siberia*, *George T. Hope*, and the *Australasia* for his own company. An 1885 note in a Duluth, Minnesota newspaper listed Davidson's fleet and noted that "Captain Davidson has contracted with the Northwestern Fuel Co. to carry 75,000 tons of coal from Buffalo, Erie and Ashtabula to Lake Superior ports. The rates are not made public, but are understood to be low."[78]

[75] *History of Bay County, Michigan* (Chicago: H. R. Page, 1883), 225.

[76] Ibid., 225.

[77] Ibid., 225-226.

[78] *Duluth Daily Tribune*, 8 April 1885.

The steamer *Frank O'Connor,* built as the *City of Naples* in 1892. Photo courtesy of the Wisconsin Marine Historical Society/ Milwaukee Public Library.

The Davidson yard produced a variety of craft during its years of operation. In 1885, the yard temporarily shifted away from large steamers and launched two three-masted schooners, the 979-ton *Polynesia* and the 928-ton *John Shaw*. The latter vessel was built for Bay City Lumber Company and served in that trade for eight years.[79] These ships were rigged as schooner-barges, the first of many such vessels the yard produced.

By the mid-1880s, local pine stocks were becoming exhausted by the furious pace of logging. Saginaw River mills, requiring a constant stream of raw material, began to depend on distant stands of timber, including those adjacent to Canada's Georgian Bay. The problem of moving Canadian logs to the Michigan mills prompted a variety of experiments in lake transportation.[80] In the winter of 1885 and 1886, James Davidson designed and built a novel log barge for the Emery Lumber Company of Bay City. The *Wahnipitae* was unlike anything afloat. At 275 feet in length, 51 feet in beam, and a scant 14 feet in depth, she was designed to carry 700,000 board feet of logs across the open lakes. The barge had five edge-joined center gunwales that supported massive deckloads and loading machinery.[81] Built at a cost of $55,000, the *Wahnipitae* could not compete with newly improved log-rafting techniques but proved very successful as a lumber barge. On one trip the *Wahnipitae* delivered 2.5 million board feet of St. Ignace lumber, stacked 21 feet high, into Buffalo. The freight bill on these and similar trips was reportedly about $7,000.[82] In 1886, in addition to the *Wahnipitae,* Davidson built the 83-foot-long, 155-gross-ton tug *Temple Emery,* which was chartered to a Chicago lumber company in 1887 for use towing logs on Lake Superior. The arrangement allowed the lumber company to apply the charter money towards the purchase of the tug at the close of the season.[83]

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[79] Bureau of Navigation, *List of Merchant Vessels of the United States,* 1894; Peter J. van der Linden, *Great Lakes Ships We Remember* (Cleveland: Freshwater Press, 1979), 355.

[80] Robert C. Johnson, "Logs for the Saginaw: The Development of Log Raft Towing on Lake Huron – Part One," *Inland Seas* 5 (1949), 37-40.

[81] *Northwestern Lumberman,* 6 June 1886.

[82] *Timberman,* 9 July 1898.

[83] Bureau of Navigation, *List of Merchant Vessels of the United States,* 1894; *Duluth Daily News,* 27 April 1887.

In 1887 the Davidson yard launched two more large steamers, the *Roumania* and *Bulgaria*, the former powered by one of the first triple-expansion steam engines on the lakes.[84] The pace of construction at the Davidson yard picked up in 1888. Between that year and 1893, the yard delivered no fewer than six Davidson vessels annually.[85]

The increased output of Davidson ships reflected both regional trends and capital improvements to the West Bay City yard. According to the federal census of 1890, the total value of Michigan shipbuilding had jumped nearly 300 percent in ten years. Of the other Great Lakes states, only Ohio, where large scale investment in iron and steel vessel building occurred early, also achieved real growth during this period.[86]

The steel age came to the Saginaw River in 1889 when Davidson's local rival, Frank Wheeler, laid the keel for his first steel ship, the sidewheeler *City of Chicago.* More significant, perhaps, was Wheeler's 1890 launching of the steel bulk freighter *Emily P. Weed,* later renamed the *Sevona.*[87]

As the Saginaw region's largest shipbuilder, Frank Wheeler provides an interesting contrast to Davidson in matters of public character and personal ambitions. Wheeler, a second-generation shipbuilder, was fascinated by technical innovations. Starting his own yard in 1877 with help from lumberman Henry Sage, Wheeler operated what may have been the finest wooden shipyard in the United States by 1881.[88] In 1888, recognizing that steel would inevitably displace wood in shipbuilding, he convinced the Bay City Council to grant a ten-year tax exemption for a proposed steel shipyard to be built adjacent to his existing facilities. That same year, Wheeler, an ardent Republican enthusiastically supported by his mostly Democratic employees, won a close election to the United States Congress.[89] A fair man by nature, Wheeler paid good wages when he could afford them but consistently overextended himself through low bids and ambitious expansion projects. By late 1890, Wheeler's yard was the biggest and most modern on the lakes. It was also laden with debt.[90]

In January 1891, Frank Wheeler sued James Davidson for $100,000. Wheeler maintained that Davidson had deliberately spread libelous rumors through the Great Lakes business community suggesting that the Wheeler Company was on the brink of failure. Wheeler made several specific charges, few of which Davidson denied. The essential fact remained that aggressive expansion into steel shipbuilding had Wheeler's company in debt over a half-million dollars. Davidson stood firm and the lawsuit was eventually dropped.[91]

Although he moved through the world of high finance, Wheeler was evidently not a good businessman. Great Lakes historian Richard Wright, a Wheeler admirer, summed up the noted shipbuilder's character and keys to success: "He relied chiefly on his talent as a shipbuilder and his ability to get along with people to pull him through the tough scrapes. Even when the going was roughest, business associates and friends were loath to permit Frank's walls to tumble about him. Frank had those qualities — honesty and sincerity — that made his creditors and his employees believe in him." Despite these traits and his progressive shipbuilding ideas, financial straits forced Wheeler to merge with the American Shipbuilding Company in 1900. His Bay City yard, once the largest and best equipped on the Great Lakes, was soon reduced to handling the huge parent company's overflow, and it closed permanently sometime after 1905.[92]

The Davidson yard's prosperity continued with the 1890s. In addition to many smaller projects in 1891, the yard launched four large bulk carriers, the 298-foot *City of Berlin* and *City of Paris* and 297-foot *City of Glasgow* and *City of London.*[93] In 1892 Davidson launched three identical carriers named after the Italian cities of Venice, Genoa, and Naples. At 301 feet in length, 42.4 feet in breadth, and 20.1 feet depth of hold, the Italian-named "city" boats were Davidson's largest vessels to date and could carry 2,600 tons of coal or 100,000 bushels of grain.[94] Although built of wood, the big freighters were driven by the most modern triple-expansion steam engines and were expensive, costing an estimated $150,000 each.[95] Steel ships were making rapid inroads into the market, but Davidson's wooden steamers remained viable commodities throughout the early 1890s. While some of the "city" boats sailed for the Davidson Steamship Company, by

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[84] Roberts, personal communication.

[85] Bureau of Navigation, *List of Merchant Vessels of the United States 1894*; Baker, *Shipbuilding on the Saginaw,* 20-21; Roberts, personal communication.

[86] U.S. Census Office, U.S. Census, *Report on Manufacturing Industries in the United States: 1890. Part III, Selected Industries* (Washington, D.C.: Government Printing Office, 1890), 550-555.

[87] Wright, *Freshwater Whales,* 119-120.

[88] Hall, *Report on the Shipbuilding Industry of the United States,* 172; Wright, *Freshwater Whales,* 116.

[89] Wright, *Freshwater Whales,* 117-119.

[90] Ibid., 122.

[91] Ibid., 122-123.

[92] Ibid., 133, 148; Baker, *Shipbuilding on the Saginaw,* 25-30.

[93] Bureau of Navigation, *List of Merchant Vessels of the United States,* 1894; Roberts, personal communication.

[94] Harvey C. Beeson, *Beeson's Marine Directory of the Northwestern Great Lakes* (Chicago and Detroit: Harvey C. Beeson, 1894); Bureau of Navigation, *List of Merchant Vessels of the United States,* 1894; Baker, *Shipbuilding on the Saginaw,* 21.

[95] Don Comtois, 1992 correspondence with the author, materials on file at the State Historical Society of Wisconsin, Historic Preservation Division, Madison, Wisconsin (hereafter referenced as Comtois, personal communication).

1895 five of the seven vessels had been sold — undoubtedly at the builder's traditional steep prices.[96]

In 1893 another major depression hit the United States and seriously dampened the Great Lakes shipbuilding industry for two years. The Davidson yard, however, barely slowed down, launching in 1893 one 196-foot and three 211-foot-long schooner-barges, the 225-foot steam-barge *W. P. Ketchum,* and the 305-foot, 2,219 gross ton *Thomas Cranage.*[97] The total listed insurance value of these vessels in 1895 was nearly $400,000, although their value in 1893 was certainly higher. Within two years of construction, Davidson had sold four of the vessels, keeping two schooner-barges *(Paisley* and *Dundee)* for the Davidson fleet, where they served for many years.[98]

The Michigan census for 1893-1894 provides a glimpse of the Davidson yard during the depression years. Davidson operated the yard full-time during the census year, employing six hundred men and paying ordinary laborers $1.25 per day and skilled mechanics $2.25 per day. Steam engines generating 1,200 horsepower drove the yard's machinery, which produced $1 million in gross income, including repairs, from $635,000 of material and $250,000 in labor.[99] These figures do not reflect the profits resulting from Davidson's other maritime enterprises.

Although not capitalizing his yard to the grand levels of Frank Wheeler, Davidson made many major improvements. A plat map of West Bay City that dates to about 1895 shows the Davidson yard as having six ship bays, most connected directly to the Michigan, Saginaw, & Mackinaw and the Michigan Central railway lines.[100] The railroads helped feed the yard's huge demand for wood. In March 1892 alone, 5,000 feet of pine logs for decking, and fifty railroad cars of oak were delivered to the yard via the Michigan Central tracks.[101] According to a local Bay County historian, the shops of the Davidson yard were housed in seventeen buildings and produced many of their own marine fixtures, including sails and cables.[102]

By 1894 the market for Davidson-built steamers and schooners began to soften and some attempt was made to diversify the yard's output. In 1895 Davidson built two huge wooden barges for the Lake Michigan Car Ferry Transportation Company. Car Ferries No. 1 and No. 2 were 317 feet in length and had a capacity for twenty-eight freight cars on their open decks. Costing about $48,000 each and equipped with steam steering and towing gear, the barges performed very well. The overall ferry service, however, was plagued by disasters, and no more of the barges were ordered.[103]

Davidson also built two smaller barges in 1895, the 147-foot long *Tycoon* and *Mikado.* Rerigged as small car ferries, the barges were sold in 1897 to the Michigan and Ohio Car Ferry Company, which operated them between Toledo and Detroit. The venture was unsuccessful but gives another glimpse of Davidson the businessman. In May 1898, Davidson filed a libel against the barges citing non-payment of the contract price. This move was designed to block a lawsuit threatened by the Michigan and Ohio Car Ferry Company against the Davidson yard for faulty workmanship in the conversion of the barges. While the yard appears to have been negligent, Davidson's legal maneuvers worked and the dispute was settled through arbitration. In the end, the ferry company failed and Davidson repossessed one of the barges.[104]

In 1896 Davidson enlarged his drydock, lengthening it to four hundred feet on the blocks with fourteen feet, eight inches of water over the sill.[105] Despite the improvements, designed to keep Davidson's repair business viable, the West Bay City yard could no longer handle the Great Lakes' biggest bulk carriers. New locks and channel improvements allowed for the operation of larger and larger vessels. Furthermore, increasing mechanization had brought steel ship costs down to per-ton prices equal to or below that of most wooden steamers.[106]

Despite the ascendancy of steel, the Davidson yard kept busy throughout the mid- and late 1890s. Between 1894 and 1903, ten steam bulk carriers and fourteen schooner-barges were built, with all but one joining the Davidson Steamship Company fleet.[107] As the 1890s drew to a close, Davidson's persistence and continued success were cause for comment throughout the lakes community. In 1898, the Michigan Department of Labor's Annual Report of the Bureau of Labor and Industrial Statistics states that:

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[96] *Inland Lloyds,* 1895.

[97] Bureau of Navigation, *List of Merchant Vessels of the United States,* 1894; Wright, *Freshwater Whales,* 125; Roberts, personal communication.

[98] *Inland Lloyds,* 1895; Van der Linden, *Great Lakes Ships We Remember,* 1.

[99] State of Michigan, *State of Michigan Census, 1893-1894* (Lansing: State of Michigan, 1894).

[100] D.A. Bullock, *The County of Bay, Michigan: Maps, History, Illustrations and Statistics* (Bay City: D.A. Bullock, 1896), 53.

[101] Comtois, personal communication.

[102] Leslie E. Arndt, *The Bay County Story from Footpaths to Freeways* (Detroit: Harlow Printing, 1982), 166.

[103] George W. Hilton, *The Great Lakes Car Ferries* (Berkeley: Howell-North, 1962), 186-198; Roberts, personal communication.

[104] Hilton, *Great Lakes Car Ferries,* 229-235; Roberts, personal communication.

[105] Roberts, personal communication.

[106] Wright, *Freshwater Whales,* 16; Laurent, "Trade, Transport and Technology," 8.

[107] Labadie, personal communication.

> The city of West Bay City is indeed fortunate in having such a progressive business man as Mr. Davidson located in their midst, for with him hard times and good times seem to be equally alike and unknown; having unlimited capital, he keeps right on producing and turning out yearly, vessels with a total valuation of nearly one and a half million dollars.[108]

In July, 1898, the *Timberman*, a logging industry trade paper, lauded Davidson as a hero:

> Wooden shipbuilding is so closely allied to the lumber business that it is as much a cognate industry as a box factory, when it is remembered that in the construction of the four immense wooden vessels launched by James Davidson the past year, nearly four million feet of timber and lumber, board measure, were consumed; and the name of James Davidson as the only prominent wooden vessel builder at present, is the single great human factor in that industry, and hence a part and parcel of the business, as much so as is Weyerhaeuser or any other great lumber producer . . . .[109]

Portions of a column in the *Detroit Free Press* of 8 November 1898 provide an insightful account of Captain Davidson's place in lake commerce and shipbuilding:

> The captain's faith in the wooden vessel of moderate size, in spite of the otherwise universal tendency toward steel vessels, is sublime. He keeps on buying timber and constructing vessels that nobody else seems to want. He is literally saying nothing and sawing wood. The captain claims, according to Detroit owners who know, that his large fleet – the largest wooden fleet ever owned on the lakes – has made a lot of money in the last two months. It is a rare thing for him to lay up any of his vessels, even in poor times. He has some influence himself with the big shippers and he takes many a contract to carry ore at low rates. He will contract his vessels every time in any sort of trade, if the times are not so good as to guarantee high wild rates.[110]

The column points out that Davidson carried no insurance, owned his own tugs and wrecking appliances, and did his own repair work, concluding: "There is no doubt that he has the economy of maintaining, operating, wrecking and repairing the large fleet to a science." As to his personal character, the newspaper noted that:

> . . . the captain pays no attention to the advice and pressure brought to bear by any other owners on the lakes. He marks out his own path and he follows it strictly, regardless whether the other owners are made enemies or friends thereby. A radical of radicals, he is also probably the most original man in the business. When he was a member of the Lake Carriers' Association he . . . always managed to say or do something entirely beyond the expectations and desires of his associates.[111]

THE GREAT SCHOONER-BARGES

James Davidson built the largest wooden bulk carriers on the Great Lakes. Among the last of these, built between 1898 and 1903, were seven three-masted schooner-barges that exceeded three hundred feet in length. The final three, *Pretoria* (338 feet), *Chieftain* (341 feet), and *Montezuma* (341 feet) were the longest wooden schooner hulls ever built. Despite their remarkable size and operational success, however, Davidson's great schooner-barges have received little serious attention, even among Great Lakes historians and marine enthusiasts.

Contributing to the Davidson vessels' virtual anonymity is a tendency among marine authors not directly familiar with the Great Lakes to discriminate against lake craft in discussions of shipbuilding. This unexamined bias is evident in Winthrop L. Marvin's 1902 evaluation of lake schooners: "The lake schooner of wood does not compare favorably in model with her new, powerful, and symmetrical sisters of the Atlantic and Pacific seaboard. She has too many suggestions in her straight up-and-down sides and blunt ends of the river scow or the canal-boat." In addition, Marvin asserted that lake schooners lacked the "staunchness" of ocean schooners. He based his spurious statements upon small "Grand Haven rig" schooners — an obsolete, marginalized class of vessels that had never been on the cutting edge of lake shipbuilding.[112]

Unfortunately, Marvin influenced the work of later authors. In his excellent 1948 study of Atlantic coal schooners, W.J. Lewis Parker, citing Marvin as his source, dismissed all Great Lakes schooners as "greatly inferior in model and finish" to his primarily Maine-built subjects.[113] When looking at Davidson schooner-barges of the same period, Marvin's and Parker's statements fail to stand.[114]

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[108] Michigan Department of Labor, *Fifteenth Annual Report of the Bureau of Labor and Industrial Statistics* (Lansing, MI: Robert Smith Printing, 1898).

[109] *Timberman*, 9 July 1898.

[110] *Detroit Free Press*, 8 November 1898.

[111] Ibid.

[112] Winthrop L. Marvin, *The American Merchant Marine: Its History and Romance From 1620 To 1902* (New York: Charles Scribner's Sons, 1902), 406; Jay C. Martin, "The Grand Haven Rig: A Great Lakes Phenomenon," *The American Neptune* 51 (1991): 201.

[113] W. J. Lewis Parker, *The Great Coal Schooners of New England, 1870-1909* (Mystic, CT: Marine Historical Association Inc., 1948), 37.

[114] The practice of ignoring Great Lakes craft continues today. In his recent *Schooners and Schooner-barges* (Farmington: Knowlton & McLeary Co., 1984) author Paul C. Morris opens with a discussion of early Great Lakes schooner barges, yet never mentions the later, technologically superior Great Lakes craft.

The advantages of the Davidson schooner-barges begin to emerge when one compares his 1902 schooner-barge *Pretoria* with William F. Palmer's 1909 schooner *Wyoming*, the last and largest wooden six-master built.

	Pretoria	*Wyoming*
Length	338.4	329.5
Width	44.0	50.1
Depth	23.0	30.4
Gross Tons	2790	3730
Net Tons	2715	3036
Capacity	5,100 tons	6,000 tons
Cap. per Gross Ton	1.83 tons	1.61 tons[115]

Even allowing for the space *Wyoming*'s builders devoted to a large sailing rig, *Pretoria* carried significantly more cargo relative to the gross dimensions of the two vessels. Relying upon traditional wooden shipbuilding methods, the builders of the coal schooners opted for structural mass, providing longitudinal support through hard pine keelsons built up six or seven feet, assisted by equally large sister keelsons, and ceiling planking often more than a foot thick. Hull strength also depended upon many internal stanchions and required small deck hatches; this made transferring the cargo particularly laborious.[116]

Despite their mass, the big schooners were tender ships, exhibiting a "snake-like quality" in rough weather and leaking badly. These problems worsened with age and contributed to the violent ends of all eleven of the six-masted schooners. In 1910, John J. Wardell, builder of the 1902 six-masted schooner *George W. Wells,* admitted that six-masters had proven impractical because they were too long for wooden construction.[117]

James Davidson, who had abandoned traditional schooner designs long before, defied the three-hundred-foot length barrier by carefully integrating steel into the hull structure. This practice added great strength with little cost in cargo capacity. In October 1900, the British trade journal *Marine Engineering* printed a detailed description of the *Pretoria*, including her steel reinforcement:

> On the outside of the frames – at the head of the frames – there runs a steel cord that is 14 in. by 7-8 in. There are also steel arches running along the steel cords amidships to the fore foot forward and under the stern aft. In addition to these the Pretoria is diagonally strapped with steel. The diagonals are 5 in by 1-2 in. These diagonals straps are riveted to the cord, to the arch and at all of the crossings, and go under the turn of the bilge about one-third of the way under the bottom. The cords, arches and diagonal straps are all let into the frames flush, and then the ship is planked so that all of the strapping is concealed.[118]

In addition, *Pretoria*'s main keelson was buttressed by steel plates eighteen inches wide by one inch thick. While *Wyoming* was also metal strapped, the design employed lighter bands of iron and was certainly inferior to those common on the Great Lakes decades before.[119]

Operating in the confined and potentially violent Great Lakes, Davidson's schooner-barges had their own problems, particularly when maneuvering in tight quarters, but the seven three-hundred-foot Davidson-built schooner-barges enjoyed an average service life of well over twenty years. Only *Pretoria,* sunk at the age of five years after losing her hydraulic steering in a devastating Lake Superior storm, had a particularly short career. Most impressively, three out of four of the final schooner-barges produced by Davidson, including the *Chieftain* and *Montezuma,* survived three decades of hard service before abandonment in the Saginaw River.[120]

How did Davidson's schooner-barges compare to the steel lake carriers of the 1890s and early 1900s? Operated in tandem, Davidson's wooden schooner-barges and steamers offered cargo capacities comparable to the steel ships of the 1890s and early 1900s and could be built at West Bay City for substantially less cost. For example, the steamer *Venezuela,* built in 1898, and her consort *Pretoria,* built in 1900, representing a total investment of about $200,000, had a combined capacity of nearly 8,000 tons.[121] By contrast, the *Rensselaer,* a 474-foot steel bulk carrier, launched at Cleveland on the same day as the *Pretoria* at an estimated cost of $350,000, carried only about 7,500 tons.[122] The structure of Davidson's business organization enhanced the competitiveness of this already low-cost fleet. Largely self-financed, owning a large fleet of tugs and major repair facilities, Davidson was also self-insured, a practice which he claimed had saved him over $1 million in premiums by 1898. In total, the integrated nature of Davidson's enterprises must have reduced his per-ton expenses to an absolute minimum, and this helps explain his wooden fleet's long persistence in an age of steel ships.

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[115] Parker, *Great Coal Schooners,* 47; Runge Collection, vessel data sheets, Wisconsin Marine Historical Society, Milwaukee Public Library, Milwaukee, WI.

[116] Parker, *Great Coal Schooners,* 43.

[117] Paul C. Morris, *American Sailing Coasters of the North Atlantic* (New York: Bonanza Books, 1979), 49; Parker, *Great Coal Schooners,* 41-44.

[118] *Marine Engineering,* October 1890, 430.

[119] Parker, *Great Coal Schooners,* 107.

[120] Dave Swayze, "The Giant Wooden Barges of the Davidson Yard," *Inland Seas* 47 (1991): 104-108. This view of large Davidson schooner-barges contrasts with another presented by Swayze, who largely discounts the economic successes of the Davidson schooner-barges, focusing instead on their difficult rough-weather handling characteristics and the "violent ends" of several of them.

[121] Ibid.; Julius E. Wolff Jr., *Lake Superior Shipwrecks* (Duluth, MN: Lake Superior Port Cities, 1990), 108.

[122] *Duluth Evening Herald,* 27 July 1900; *Lake Carriers Association,* 1907: 65; Roberts, personal communication; Labadie, personal communication; Runge Collection, vessel data sheets.

In 1910, James Cooke Mills, describing the ongoing evolution of Great Lakes freighters in his book *Our Inland Seas,* remarked upon "the fine wooden steamship and consorts of large capacity, such as are of considerable importance in the lake shipping to this day." Mills singled out the Davidson fleet as "the best of its class afloat upon any waters of America" and predicted that the "staunch wooden ship will likely continue a factor in the carrying trade for a number of years to come."[123] Mills was correct. The Davidson fleet survived two more decades, remaining active until the Great Depression.

CONCLUSION

The 1903 construction of the 341-foot *Montezuma* consumed the last of Davidson's oak supplies suitable for large vessel construction. After that, the yard produced only a handful of small utility craft. Repair work, however, continued for nearly thirty years. Fittingly, the final ship serviced at the Davidson yard before it suspended operations in 1932 was the old Davidson-built schooner-barge *Grampian,* built in 1894.[124]

James Davidson died in 1929 and left a financial legacy that included investments in numerous shipping companies, shipyards, and banks across the lakes. In a career that spanned over a half-century of almost perpetual change, Davidson used his shrewd business mind and imaginative shipbuilding skills to take advantage of opportunities of the moment. Most significantly, he chose to continue building ships of wood rather than steel. He was successful because he used the great reserves of midwestern oak to build high-quality wooden ships at competitive prices. He helped create demand for his own product by increasing ship size and improving construction techniques. In the process, he amassed a fortune and built the most technologically advanced wooden ships in America.

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123. James Cook Mills, *Our Inland Seas: Their Shipping and Commerce for Three Centuries* (Chicago: A.C. McClurg, 1910), 217-219.

124. Bureau of Navigation, *List of Merchant Vessels of the United States, 1931*; Arndt, *The Bay County Story,* 166; Peter J. van der Linden, *Great Lakes Ships We Remember II* (Cleveland: Freshwater Press, 1984), 302.

The Reconstruction of Coasting Schooners From Tonnage Admeasurements

EDWARD G. BROWNLEE

Toward the end of the of the Civil War, the coastwise trades in the United States revived and began to prosper. Expanding industries demanded coal, lumber, and manufactured goods. Rail service was inadequate, but there were plenty of seafaring people eager to sail and manage ships. Steamships became increasingly popular for ocean transportation, but sail still dominated coastal shipping. Between the Civil War and 1885, the coastwise fleet expanded to include some 2,200 three-masted schooners, popularly called terns.[1] In addition to these were the two-masted schooners, half brigs, barkentines, and the later four-, five-, and six-masted schooners. Unfortunately, many of the primary records of such vessels have disappeared, and accurate dimensional and structural information on wooden sailing vessels built before World War I is woefully lacking.

In the nineteenth century, the half model was the principal design medium for wooden ships. Half models used for construction were usually not given a fine finish, were not ornamental, and were usually bulky, heavy, and difficult to display. Most eventually ended on the woodpile. Of the many sizeable vessels built in South Jersey at Dennisville, Mauricetown, Bridgetown, the Egg Harbors, Camden, and lesser ports, few builder's models have survived. Comparison of register dimensions shows that South Jersey vessels were not commonly duplicated; therefore, the number of models lost must be great. Exceptions were the *Gertrude Abbott* and her two sisters built in Dennisville in the years 1882, 1883, and 1884, and the smaller *Edith T. Gandy* and *Emily S. Baymore,* built there in 1883 and 1884. At the height of the construction boom of 1880-1885, Samuel W. Tilton of Cooper's Point in Camden built as many as ten vessels from a single model, a spectacular and very uncommon performance, still under study.

Builders of iron and steel vessels drew plans. Some of these builders also produced wooden vessels, but the latter were nearly always constructed from models in the traditional manner. Sailmakers plotted their measurements to scale on paper to prove accuracy, but the drawings and other records of the most prominent sailmakers, many of

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The author wishes to thank the many people who assisted in the preparation of this article. E. Ann Wilcox (librarian, Philadelphia Maritime Museum) introduced the author to the tonnage admeasurements records under her care, helped with research, and provided additional aid through her assistants Anna Lisa Little and Adam D. Wilson and library volunteers Ben Thomas and Larry Kelly. Angie S. Van Dereedt (Civil Reference Branch, National Archives, Washington, D.C.) retrieved many helpful documents. Josef Leiner of Pot Pie, Wittman, MD (former Senior Supervisor of the boat-building shop of the Philadelphia Naval Shipyard) is one of the last South Jersey boat builders to grow up in the tradition of heavy wooden construction; his knowledge and library made many contributions to this project. John Dubois of Absecon, NJ (last operator of the Vannaman Shipyard at Mauricetown, NJ, and an owner and operator of oyster schooners) was responsible for preserving many of the surviving builder's models of larger South Jersey vessels, including that of the *Gertrude Abbott* which is now displayed in the museum named for him and operated by the Cumberland County Historical Society, Greenwich, NJ. Mrs. Betty Harrington MacDonald of Alexandria, VA, wrote the very useful *Mispillion-built Sailing Vessels, 1761-1917* and owns the last known model from the prolific Abbott shipyard in Milford, DE. Robert H. Burgess, the well-known Chesapeake Bay marine historian, was responsible for preserving many now priceless photographs, including that of the *Josephine Wimsatt* on page 132. Captain W. J. Lewis Parker of Camden, ME, is a leading historian of the coastwise schooner fleet; his prodigious museum/library yielded much important material. Francis E. (Biff) Bowker (Mystic Seaport Museum) is one of the few of us still living who experienced life in sailing coasters; his writings provide a valuable record, and he offered important encouragement and advice. Nancy D'Estang (Mystic Seaport Museum) brought to my attention the tonnage admeasurement certificates located in the National Archives, Waltham, MA. Peter Lesher (curator of the Chesapeake Bay Maritime Museum, St. Michael's, MD) furnished information on the research of his grandfather John G. Earle. Fred and Betty Erhardt (respectively, librarian and curator of the Atlantic County Historical Society, Somers Point, NJ) loaned the model of the *Emma L. Cottingham* for study by the author and provided a photograph of the vessel's portrait and a vast store of background data pertaining to local sailing vessels. Merville E. Willis, naval architect, and Jane Allen, curator of the Philadelphia Maritime Museum, contributed very helpful criticism. David B. Brownlee (professor at the University of Pennsylvania and the author's son) encouraged and assisted this work.

[1] For a listing of these vessels, see Francis E. Bowker, *Three Masted Schooners: A Compilation of Three-Masted Schooners Built on the American East Coast* (Mystic, CT: Mystic Seaport Museum, 1991).

whom were part-owners of ships, were destroyed after the vessels were out of service. Very few sail plans have been found, and no plans of wooden sailing vessels built in New Jersey have been found.

Plans were also drawn for some of the last wooden sailing vessels, built in the World War I boom of 1915-1920, but most of these have also disappeared. The construction and sail plan exists for the four-masted *Copperfield,* built at Mobile, Alabama in 1919, but Captain Walter Wrightson, who owned her and supervised her building, made many changes to the plans.[2]

Good photographs of the South Jersey coasters are rare and seldom show deck and structural details. Most of these vessels were launched without masts and did not present an impressive picture. Existing paintings apparently satisfied their purchasers, but many must be questioned regarding proportions and details. Some were no doubt made without full knowledge of the vessel and have inaccuracies.

Fortunately, a better source of information for late nineteenth-century coasters exists in the tonnage admeasurement records created after the adoption of the so-called Moorsom system in 1865. Determination of tonnage was necessary as a basis for taxation, port charges, and manning, and the required measurements supplement the information available on Certificates of Register and Enrollment, which give principal dimensions only.

INTRODUCTION OF THE MOORSOM SYSTEM

The document called "Tonnage Admeasurement" came into use in 1865 in compliance with *An Act to Regulate Admeasurement of Tonnage of Ships and Vessels of the United States, May 6, 1864.*[3] The rules under this act closely followed those of the British Merchant Shipping Act of 1854, incorporating the Moorsom Measuring System. This method, named for George Moorsom, surveyor-general for tonnage of the British Board of Trade, was adopted as a result of dissatisfaction with the overly simplistic existing rules, which, in addition to yielding inconsistent and inadequate results, had a detrimental effect on ship design.[4]

The Moorsom system measures volume by using Simpson's First Rule, a method for calculating the areas of irregular plane figures and the volumes of irregular three-dimensional forms (such as the hulls of ships) from simple linear measurements.[5] Volume in cubic feet, as determined in this manner, was then converted into tonnage by the equation 100 cubic feet = 1 ton. The accuracy of the results depended on the care exercised by the surveyors in physically taking the numerous measurements from a vessel.[6]

The surveyor first recorded his measurements in a pocket notebook, a printed form called an "Arundel Diagram" (see illustration opposite and note 10), or sometimes on plain paper. These data were later transcribed onto a larger form entitled "Tonnage Admeasurement," which recorded register dimensions, rig, number of masts, and number of decks. This record was used to calculate tonnage and was followed by a "Tonnage Certificate," certifying that the admeasurement had been completed and stating the tonnage thus found. This certificate entitled the vessel to license, enrollment, or registration, the latter being required for foreign voyages. In the beginning, the certificate provided a place for the signature of an owner's representative. This was soon abandoned, no doubt because most owners and masters lacked the knowledge necessary to judge the accuracy of the computation and balked at a formal acceptance. For many years the procedure was surrounded by an aura of mystery which some measurers were pleased to foster. Unfortunately, little is known about the early measurers or surveyors. The printed certificates were marked for their signatures, but in actual practice, at least in the large custom houses, few signed. Drawings made from their measurements show that they exercised considerable skill in spite of working with simple equipment. Some may have had lofting experience. The fee for measuring the double-decked *Gertrude Abbott* in 1882 was $18, based on recording ten hull sections at $1.50 each plus two enclosed spaces at $1.50 each, as prescribed by law. A Camden, New Jersey ship carpenter at that time earned about $18 per week, with lower rates prevailing south of Camden and higher pay in New York.

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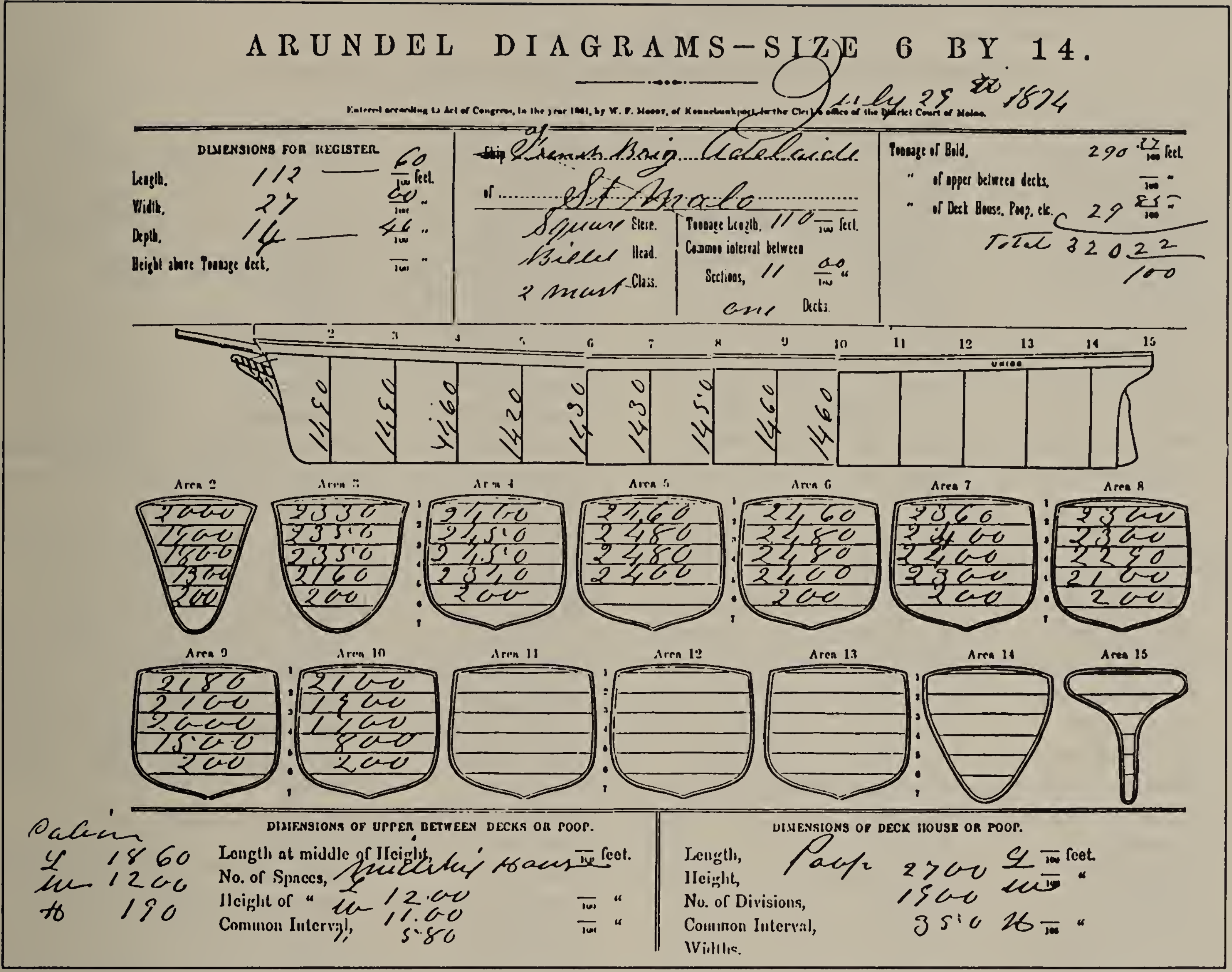
[2] This author, who sailed on the *Copperfield* in 1932, now holds the construction and sail plan and was able to record the changes before the vessel was lost.

[3] R. T. Cunningham and Phillips Stitt, "Tonnage Measurement," in *Ship Design and Construction,* ed. Robert Taggart (New York: The Society of Naval Architects and Marine Engineers, 1980), ch. 5, sec. 1.

[4] Andrew Murray, *The Theory and Practice of Ship-Building* (Edinburgh: Adam and Charles Black, 1861), 157-158. A helpful brief of systems in effect prior to adoption of Moorsom's method is given in David R. MacGregor's *Fast Sailing Ships, Their Design and Construction, 1775-1875* (London: Conway Maritime Press, 1988), 23-25.

[5] P. G. Wallis, "Simpson, Thomas," in *Dictionary of Scientific Biography,* ed. Charles Coulston Gillespie (New York: Charles Scribner's Sons, 1975), 443-445.

[6] It is not the intent of this paper to describe the computation of tonnage under the Moorsom system, nor all details of the regulations, but to introduce methods of translating the recorded measurements into graphic representations of late nineteenth-century coasting schooners. Those interested in the technical details should consult the *Code of Federal Regulations,* 46, etc., and I. R. Butts, *The Merchant's and Shipmaster's Manual and Shipbuilder's and Sailmaker's Assistant* (Boston: I. R. Butts and Co., 1873). The former is the modern but little-changed version, and the latter is contemporary with the period discussed.



ARUNDEL DIAGRAMS—SIZE 6 BY 14.

July 29th 1874

Entered according to Act of Congress, in the year 1861, by W. F. Moore, of Kennebunkport, in the Clerk's office of the District Court of Maine.

DIMENSIONS FOR REGISTER.

Length, 112 — 60/100 feet.
Width, 27 60/100 "
Depth, 14 — 46/100 "
Height above Tonnage deck, /100 "

~~Ship~~ of French Brig Adelaide
of St Malo
Square Stern.
Billet Head.
2 mast Class.

Tonnage Length, 110 /100 feet.
Common interval between Sections, 11 00/100 "
one Decks.

Tonnage of Hold, 290 77/100 feet.
" of upper between decks, /100 "
" of Deck House, Poop, etc. 29 85/100 "
Total 320 22/100

Area 2: 2000, 1900, 1800, 1300, 200
Area 3: 2330, 2350, 2350, 2160, 200
Area 4: 2460, 2450, 2450, 2340, 200
Area 5: 2460, 2480, 2480, 2400
Area 6: 2460, 2480, 2480, 2400, 200
Area 7: 2360, 2400, 2400, 2300, 200
Area 8: 2300, 2300, 2290, 2100, 200
Area 9: 2180, 2100, 2000, 1500, 200
Area 10: 2100, 1900, 1700, 800, 200
Area 11
Area 12
Area 13
Area 14
Area 15

Palin
L 1860
w 1200
h 190

DIMENSIONS OF UPPER BETWEEN DECKS OR POOP.

Length at middle of Height, Wheeling House /100 feet.
No. of Spaces, L 12.00
Height of " w 11.00 /100 "
Common Interval, h 5.80 /100 "

DIMENSIONS OF DECK HOUSE OR POOP.

Length, Poop 2700 L /100 feet.
Height, 1900 w /100 "
No. of Divisions,
Common Interval, 350 h /100 "
Widths.

Arundel Diagrams of the French brig *Adelaide*, 29 July 1874. Illustration courtesy of the National Archives, Washington, D.C.

FINDING TONNAGE ADMEASUREMENT RECORDS

The U.S. Customs Service was established by an act of Congress on 31 July 1789. It became a part of the Department of the Treasury shortly thereafter and was charged with issuance and administration of marine documentation. In the 1860s this agency became the Division of Customs and retained this title until renamed the Bureau of Customs in March 1927. Under the War Powers Act of 1941, admeasurement and certain other functions were assigned to the Commissioner of Customs.[7]

The principal repository of tonnage admeasurement forms from the sailing ship period is the National Archives and Records Administration (NARA), Record Group 41, Records of the Bureau of Marine Inspection and Navigation. Their files cover the period 1789-1931 and are arranged geographically by name of port, thereunder chronologically by year, and thereunder numerically by document number. There are many apparent gaps in these records, which have received slight notice due to a lack of public interest. Alphabetical indexes for the records of only a few districts have been found, and there is no common index for all districts. Present plans are to retain these records in Record Group 41 at their present Washington, D.C. location.

The regional offices of the National Archives also hold some admeasurement records. The Waltham, Massachusetts branch has records of some New England fishing vessels, and the Northeast Regional Office in New York, New York has tonnage admeasurement records for the port of New York from 1878 to 1917.[8]

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[7] Forrest R. Holdcamper, *Preliminary Inventory of the Records of the Bureau of Customs (Record Group 41)* (Washington, D.C.: General Services Administration, National Archives and Record Service, 1968), 1-11.

[8] Information regarding records at the National Archives, Waltham, MA, was provided by Nancy D'Estang, Mystic Seaport Museum.

Table 1

Tonnage Admeasurement Records in the National Archives, Washington, D.C.

Annapolis, MD	1895 only	Louisville, KY	1866-80
Astoria, OR	1875-99	Middletown, CT	1798-1858, 1863-99, 1903-8
Baltimore, MD	1802-1912	Milwaukee, WI	1871-81
Barnstable, MA	1852-62, 1865-74, 1883-95	Mobile, AL	1820-24, 1855-58, 1865-1920
Bath, ME	1865-1901	Morgan City, LA	1869-90
Beaufort, NC	1875-1903	New Bedford, MA	1808-84, 1889-92, 1903-4
Belfast, ME	1865-1914	New Haven, CT	1808-17
Biloxi, MS	1863-77	New Orleans, LA	1824-33, 1865-94
Boston, MA	1871, 1874-1901	Norfolk, VA	1862-90
Brashear, LA	1871-78	Oswego, NY	1833-1921
Bridgeport, CT	1869-67, 1882-83, 1893-96	Pensacola, FL	1893-1906
Bridgeton, NJ	1859, 1861, 1893-96, 1910	Philadelphia, PA	1793-1870, 1878-79, 1882-1900, 1915
Brunswick, GA	1896-1913	Pittsburgh, PA	1865, 1877-99
Buffalo, NY	1865-95	Portland, OR	1870-88
Camden, NJ	1866-74, 1876-81, 1892-98	Portsmouth, NH	1815-91
Castine, ME	1870-1911	Rochester, NY	1880-91
Cedar Keys, FL	1884-1912	Rockland, ME	1871-83
Charleston, SC	1866-97	Rockport, ME	1887-1912
Chicago, IL	1872-1903	St. Louis, MO	1865-99
Cleveland, OH	1870-82	St. Michaels, AL	1898-99
Detroit, MI	1870-92	St. Paul, MN	1870-1903
Edenton, NC	1879-80	San Francisco, CA	1850-1931
Ellsworth, ME	1865-1903	Savannah, GA	1869-1913
Fairfield, CT	1789-1831, 1865-92, 1897-1900	Searsport, ME	1865-82
Fall River, MA	1871-91	Somers Point, NJ	1913-1914
Fernandina, FL	1870-84	Stockton, ME	1866-75
Georgetown, DC	1833-67, 1882-83	Tampa, FL	1887-1905
Hartford, CT	1880-1901	Waldoboro, ME	1845-67, 1871-1913
Havre de Grace, MD	1865	Wheeling, WV	1865-67, 1871-98
Jacksonville, FL	1860-1901	Yorktown, VA	1870-99
Key West, FL	1891-93		

A few records are held elsewhere. The collection of the Philadelphia Maritime Museum includes admeasurement certificates from the Philadelphia Customs District between 10 January 1870 and 1919. The printed seventeen-by-twenty-two-inch forms are folded in half and bound into volumes, each containing about two hundred tonnage admeasurements. These may be returned to Washington in the near future.

The Philadelphia District eventually took over the admeasurement duties of other nearby districts. In the cases of vessels built in Delaware and Maryland, the choice of customs district for admeasurement was based on the builder's ability to access a major body of navigable water. Thus, vessels built at Seaford, Delaware on the Nanticoke River, which flows into Chesapeake Bay, were expected to be admeasured in a Chesapeake Bay port, and those from Milford, Delaware, on the Mispillion River, flowing into the Delaware River, were expected to be admeasured in Philadelphia. It was disconcerting to find that a number of large schooners built in Camden, New Jersey had their admeasurements recorded in the books of the Great Egg Harbor District, apparently to suit principal owners who had ties in that area. Also located with the tonnage admeasurements at the Philadelphia Maritime Museum are those from Bridgeton, New Jersey, 1880 to 1892; Little Egg Harbor, New Jersey, 12 November 1873 to 27 September 1895; Great Egg Harbor, New Jersey, 26 March 1870 to 11 April 1892; and Wilmington, Delaware, 1877 to 1886.

WHAT TONNAGE ADMEASUREMENTS REVEAL

The Moorsom system of calculating tonnage, adopted in 1865, provides a reasonable basis for generating a pictorial representation of a vessel. The earlier simplified formulae for tonnage are of no value in this regard.

Unfortunately, researchers have made little use of tonnage admeasurement certificates. These were not active documents, subject to frequent renewal or change; they were inscrutable to many laymen, and those responsible for measuring often discouraged their review. Howard Chapelle was surely aware of the existence of these records, but during his life they were not readily available to the public, and he was no doubt too busy with the abundance of unpublished material then available to consider a study worthwhile.[9] John G. Earle, a mechanical engineer and ardent student of Chesapeake Bay craft, became aware of tonnage admeasurements before 1968, and in that year he visited the National Archives in Washington, D.C., where he examined and copied records. He continued this study through 1970, learning how to reconvert tonnage admeasurements into lines drawings.[10]

The admeasurements also provide a chronological record of shipbuilding types and trends within each custom house district. The business depression between 1874 and 1878 clearly shows in the records, as does the rise and fall of individual builders.

An example of the kind of activity documented in the Philadelphia records is the amazing productivity of the small shipyards on Cooper's Point, Camden, New Jersey, between 1865 and 1885. During this period, Cooper's Point was a place-name, used in official shipbuilding records and known to all coastermen, as was the adjacent Cooper's Point anchorage.

A boom in canal construction spurred the building of hundreds of canal boats, many canal schooners, and sailing scows from 1871 through 1875, and the records chronicle this construction as well. Although very similar, each of these vessels was given an often whimsical name, and each was usually individually admeasured.

The Philadelphia Maritime Museum collection records sloops, cat-boats, schooners of two to four masts, half-brigs, three-masted barkentines, and a few barks and ships. Many foreign craft and U.S. vessels built in other districts are included. The three-masted schooner, or tern, dominates the sailing fleet, and there are prolific records of steamships, barges, and miscellaneous harbor craft.

Names of shipbuilders were not always clearly stated in early records, and the implementation of the new admeasurement system in 1865 did little to remedy this problem. The situation was particularly confusing on Cooper's Point, where shoulder-to-shoulder shipyards occasionally seem to have been referred to as one. Moreover, vessels were often built on leased property by master carpenters who moved from job to job. Between 1865 and 1877, many Philadelphia district admeasurements simply gave the place of building without naming the builder in the designated space on the form.

Master carpenter's (or shipwright's) certificates, another source of information on builders, are difficult to find. The master carpenter's certificate was the first of the ship's documents to be filed and was a statement to the government that the vessel had been constructed. It entitled the vessel to receive United States registry and the privilege of trading coastwise between U.S. ports. Such certificates were often treated lightly and signed by almost any available shipyard official. Occasionally, however, these documents offer a fascinating glimpse into shipbuilding procedures. For instance, the very informal certificate for the sixty-foot scow-schooner *Morning Star,* built in 1848 at Alloway Creek, New Jersey, bore the signatures of three men described as master carpenters, probably the entire construction gang. Neither in the master carpenter's certificates nor elsewhere in the surviving governmental documentation is the actual designer (or maker of the half model) identified.

Tonnage admeasurements can be useful in the identification of builder's models. For example, a study of tonnage admeasurements demonstrated that a model alleged to represent the tern *Gertrude Abbott,* built at Dennisville, New Jersey, in 1882, had been correctly identified, as shown in figures 5 and 6 on page 129, and also showed that the *Lizzie Babcock* and *Isaac H. Tillyer* came from the same model.[11] The lines derived from

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[9] Howard I. Chapelle, *The National Watercraft Collection,* Smithsonian Institution Bulletin 219 (Washington, D.C.: Smithsonian Institution, 1960), 6-8.

[10] John G. Earle (1901-1992), who also had training in naval architecture, became interested in the use of tonnage admeasurements as a historical research tool about 1968. He was a friend of Marion Brewington, with whom he corresponded on the subject, and he drew the plans of log canoes illustrating Brewington's *Chesapeake Bay Log Canoes and Bugeyes* (Newport News, VA: Mariners' Museum, 1937). Earle obtained records from the National Archives in Washington and learned how to develop a set of internal lines. He found the work arduous, but he put together an extensive collection of measurements, mainly of the Chesapeake Bay craft that were his chief interest. His papers are in the possession of his grandson Peter Lesher, curator of the Chesapeake Bay Maritime Museum, who hopes to use them for the benefit of students.

Earle's study of tonnage admeasurements was based on the documents entitled "Arundel Diagrams," which were apparently the surveyors' working records of dimensions that were later transferred to the "Tonnage Admeasurement" certificates on which the actual calculation of tonnage was made. Distinct forms were provided for vessels of different sizes; these forms were designated according to the number of vertical divisions of each measured section and the number of such sections: "4x8," "6x8," etc. Earle's records contain six different forms of Arundel Diagrams. Each form bears a profile view of a ship hull with clipper stem and bowsprit, facing left as in British practice, with cross-sections below. (The sections on tonnage admeasurement certificates are also numbered from left to right.) The breadth and depth stations are represented by lines on which dimensions are to be recorded. Surveyors sometimes assembled their initial records in pocket notebooks rather than on the printed Arundel Diagrams. The use of the diagrams died out in the late 1870s, for they were impractical for representing the huge variety of water craft – from catboats to full-rigged ships and possibly steamboats.

[11] The model is in the collection of the Cumberland County Historical Society, Greenwich, NJ.

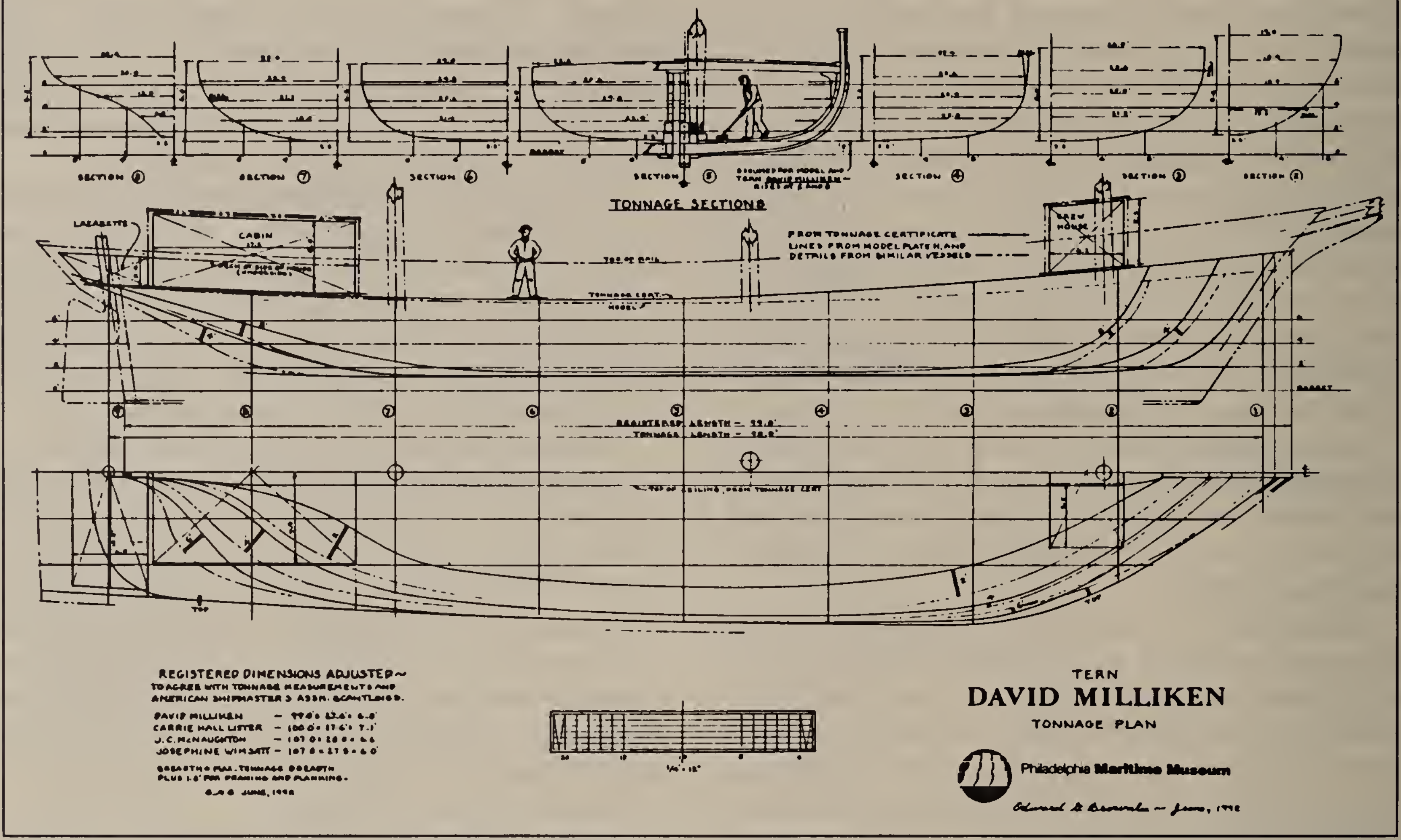
TONNAGE SECTIONS
LAZARETTE
CABIN
REGISTERED DIMENSIONS ADJUSTED~
TO AGREE WITH TONNAGE MEASUREMENTS AND
AMERICAN SHIPMASTER'S ASSN. SCANTLINGS.
DAVID MILLIKEN – 99.0 × 23.4 × 6.8
CARRIE HALL LISTER – 100.0 × 17.6 × 7.1
J. C. McNAUGHTON – 107.0 × 28.0 × 6.6
JOSEPHINE WIMSATT – 107.0 × 27.0 × 6.0
TERN
DAVID MILLIKEN
TONNAGE PLAN
Philadelphia Maritime Museum

Figure 1: Tonnage plan of the tern *David Milliken.* This and all other original drawings are by the author. Copies of the originals may be obtained from the Philadelphia Maritime Museum, Philadelphia, Pennsylvania.

another model, shown in figure 7 on page 131, proved to be impossible to associate with any vessel from its known region.[12] Furthermore, information contained in tonnage admeasurements provided the basis for reconstructions of the *David Milliken* (figure 1 above), *Belle Halladay* (figures 8, 9, and 10 on pages 133 and 134), and the *Emma L. Cottingham* (figures 11, 12, and 13 on pages 137 and 138). Only a photograph supplemented the *Halladay*'s tonnage admeasurement. The admeasurements have revealed many previously unknown details of structural arrangement; dimensions are given for the poop and lower decks, houses, and lazarettes. For example, specifics of the *Emma L. Cottingham*'s centerboard trunk were revealed by plotting the breadth measurements from her tonnage admeasurement, the thickness of the centerboard well having been omitted. Most of the Delaware and New Jersey coasters, like the *Cottingham,* had centerboards, nearly always offset to the starboard side of the keel, but their builders have left no details of construction.

A by-product of the study of the *Belle Halladay* is an interpretation of the conditions existing when the photograph on page 121 (opposite) was taken. One or two people appear on deck, but they are not engaged in enlightening activity. Her yawl-boat is not secured for sea, and her anchor cable is not visible. The three headsails, loosely hoisted, with all others stowed, present a very unusual configuration for a vessel away from a wharf. As the profile view was developed from the tonnage measurements and the photograph, it became apparent that the vessel was trimmed deeper in the water foreward than aft. A small sharply breaking wave seems to indicate a shoal or beach in the foreground. All indications are that the *Halladay* is aground aft and hoping to work off with the sails set forward.

Much has been learned about the measuring process and the relationship between measurements used for different purposes. Many scholars, including Howard Chapelle, have been baffled by the conflict between registered dimensions and those obtained from models or other sources.[13] Comparison with models has shown that tonnage admeasurement yields an accurate representation of hull form and that registered dimensions taken during the period studied are often unreliable. Once Moorsom's system was adopted, registered dimensions lost importance. They did not determine fees or costs, were apparently not certified by careful measurement, and were

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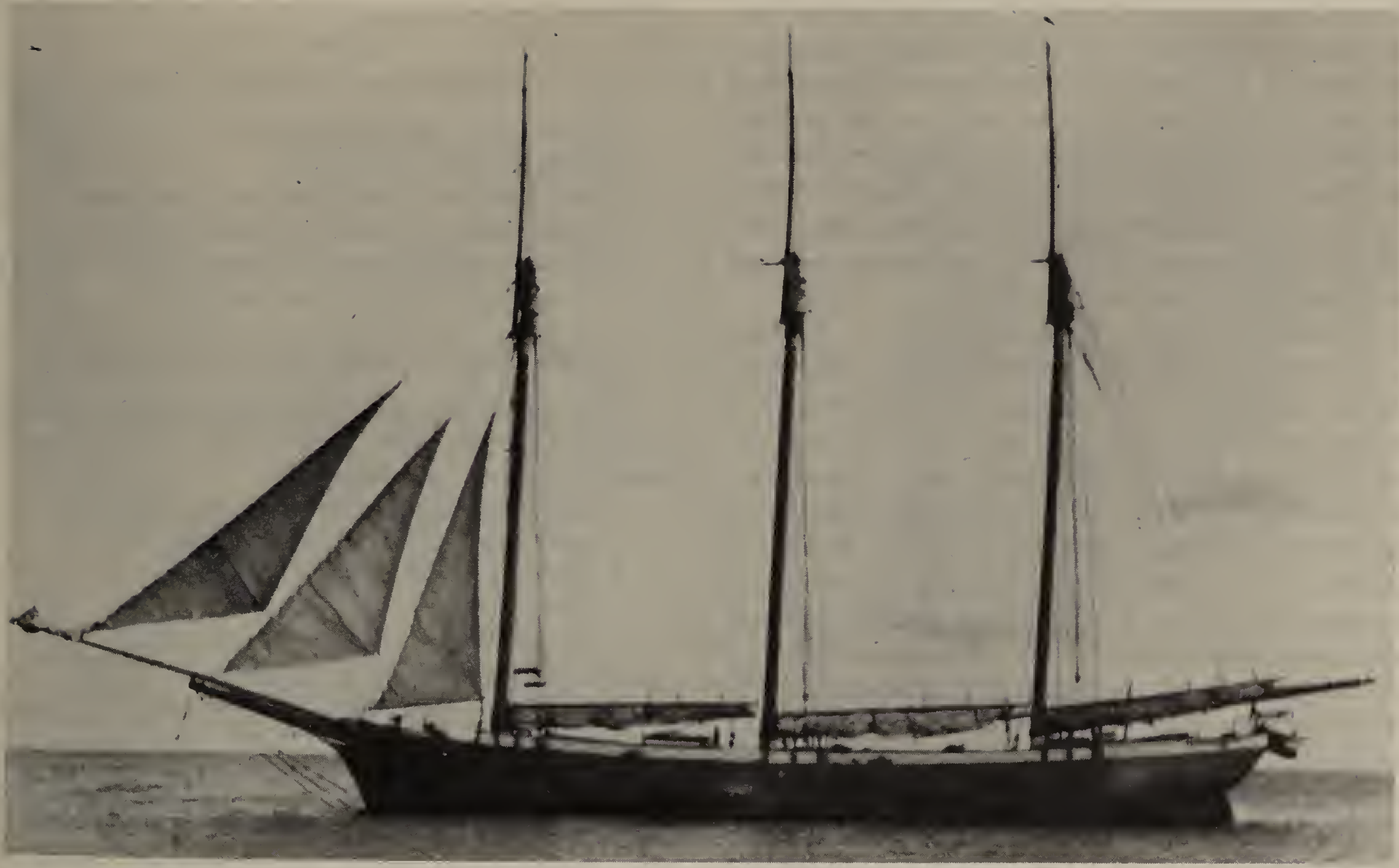
[12] The model is in the collection of Betty Harrington MacDonald, Alexandria, VA.

[13] Howard Chapelle, *The National Watercraft Collection,* 6, 7.



The tern *Belle Halladay.* Photo courtesy of the Mariners' Museum, Newport News, Virginia.

possibly understated in the hope of warding off taxes that might at some date be calculated on the basis of registered dimensions. In the case of the *Gertrude Abbott* and her sisters, the registered length was found to be about eleven feet less than if it had been measured in accordance with prescribed rules; it was apparently the approximate length on straight keel. On most wooden sailing craft the maximum (or registered) breadth occurred at only one point along her length. With consideration of tumble-home, this point was not always readily found, but again, because the dimension had no legal significance, it was treated lightly. When compared to breadths recorded in tonnage admeasurement and breadths taken from half models (adjusted for model shrinkage, with the addition of plank and frame thicknesses), registered breadths are often shown to be deficient.

Registered depths seem to be more accurate than registered lengths and breadths, but recording of single and double-decked hulls was sometimes confused. A puzzling example is the single-decked tern *Belle Halladay,* whose registered depth was 9.6 feet, but whose 100-foot long by 4.2-foot high poop deck effectively, although not legally, made her a double-decker, with registered depth of about 14 feet. This design treatment was popular in South Jersey. The long poop and well-deck forward offered several advantages: the sunken deck, anchor windlass, and appurtenances were protected by a high bulwark, with the vessel presenting a low forward profile and sail plan. The bowsprit was entirely above a watertight deck as recommended by insurance underwriters. The tonnage measurements were easier to obtain, with the uppermost deck, or poop, separated from the under-deck space. This, however, did not guarantee a beneficially low tonnage. The similarly arranged *Emma L. Cottingham* was wrongly declared a double-decker in the American Shipmasters' Association records, with a registered depth of 15.9 feet. The measurements and tonnage calculations for both vessels were correctly made for a single deck, poop deck configuration.

Many scholars have assumed that builders frequently made wide departures from their models when constructing wooden ships. Tonnage admeasurement records indicate that this was not so, at least in the case of seagoing vessels. The builder carved his model carefully and no doubt faired it with battens to prove the lay of the planking. After this investment of time and energy, probably expended during the slow winter season, he could not afford to waste time once construction was underway during the busy warmer months by modifying the underwater form or the end profiles. Simpler changes, however, were instituted. Length was frequently changed by addition or subtraction of frames or possibly alteration of the frame spacing. A more unusual method was disclosed by the plot of the tonnage admeasurements of the *Emma L. Cottingham,* which revealed that the stem had been moved about three feet ahead of the position indicated by the model and that the lines of the forebody were faired to it in an unknown manner. Depth and sheer line were easily adjusted on the actual frame of the vessel, and this was done frequently — even changes between single- and double-deck configurations.

Another sometimes confusing facet of tonnage admeasurements — but one providing useful data to the modern scholar — was the use of "exemptions" and "deductions" in the determination of gross and net tonnage. Of course, because of the significance of tonnage for the assessment of taxes and port charges, owners were interested in making all possible reductions in order to generate a low taxable tonnage for their vessels. These reductions were made in either of two ways. Exempted spaces were simply omitted from measurement, although they were sometimes verbally declared (without quantification) on admeasurement certificates or Certificates of Enrollment. Deducted spaces were measured and then subtracted from the computed total tonnage.

When the Moorsom system was implemented in 1865, it was apparently assumed that paying cargo could be carried in almost every enclosed space in a vessel except for certain "exempt" areas, including engine rooms, galleys, and centerboard trunks. Treatment of such areas, however, varied in practice. For instance, in 1874 the *Elizabeth M. Beuhler* and the *Rillie S. Derby* had their galleys subtracted only after remeasurement (although they should apparently have been exempted at the start). The 1875 admeasurement certificate of the centerboarder *Emma L. Cottingham* records no exemption of a centerboard trunk, although a study of her detailed measurements discloses that the trunk was actually not included in tonnage. In 1877 the *Martie A. Holmes*'s Certificate of Enrollment declared that her centerboard trunk and galley were exempted, apparently following the correct procedure, but the *Gertrude Abbott,* measured in 1882, received no exemption for her centerboard trunk.

In 1882, measurement regulations were changed and the newly devised concept of "deductions" was implemented. This permitted further reductions in taxable tonnage, no doubt with the support of the shipowners who hastened to have their vessels remeasured.[14] Rather than completely changing the system, the pre-1882 exemptions were retained and a new list of deductions was devised. Under the revised system, the "gross" tonnage was permitted to be reduced by the amount of the allowable deductions to create the "net" or "register" tonnage, which was used thereafter for the computation of taxes and fees based on freight capacity. The net or register tonnage had to be carved on the "main beam" of the vessel (not always easily defined), and permissible deducted spaces also had to be permanently marked. In lieu of itemizing deductions, the owner could accept a single deduction of 5 percent of the gross tonnage, usually declared simply as "crew space." Gross tonnage remained the measure of size for licensing and for determining those fees not associated with carrying capacity.

Table 2

Exemptions from Tonnage (69.03-63)*

1. Companions and booby hatches
2. Galleys (fitted with ranges)
3. Skylights (over spaces other than engine rooms)
4. Waterclosets (if accessible to entire crew)
5. House for donkey engine and boiler (if above main deck)
6. Wheelhouse (with some size limitations)

Deductions from Tonnage (69.03-75 and 69.03-77)*

1. Crew spaces (all spaces exclusively for officers and crew, including bathrooms, mess rooms, oilskin lockers, pantries, sleeping rooms, and passageways)
2. Master's cabin and associated rooms
3. Spaces used exclusively for navigation
4. Space for capstan and anchor windlass
5. Chain locker
6. Bosun's storeroom (with size limitations)
7. Chartroom (with size limitations)
8. House for donkey engine and boiler (normally *exempted* under 69.03-63)
9. Space devoted to sail storage (up to 2.5 percent of gross tonnage)

*Code of Federal Regulations 46, Part 69.

For the purpose of reconstruction, the importance of deductions lies in the detail exposed when they were itemized by the measurer — when all individual spaces, often including berths, were recorded. One must feel sorry for the "steward" (the cook) of the *Gertrude Abbott,* whose stateroom in 1898 measured 5.1 feet long by 2.4 feet wide by 7.6 feet high, and whose berth was 5.1 feet long by 3.5 feet wide by 4.3 feet tall (height under the side deck).

Another interesting piece of information appears in the 4 November 1882 remeasurement of the tern *Annie C. Grace,* which reveals an error in her original admeasurement of 1 November 1880. The first certificate gives the height of her 81-foot long poop deck as 2.8 feet. Such a height appears to be quite impractical, and strangely, it is

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[14] Records for such remeasurements may be difficult to locate, since vessels were not necessarily remeasured in the Customs Districts in which they were constructed.

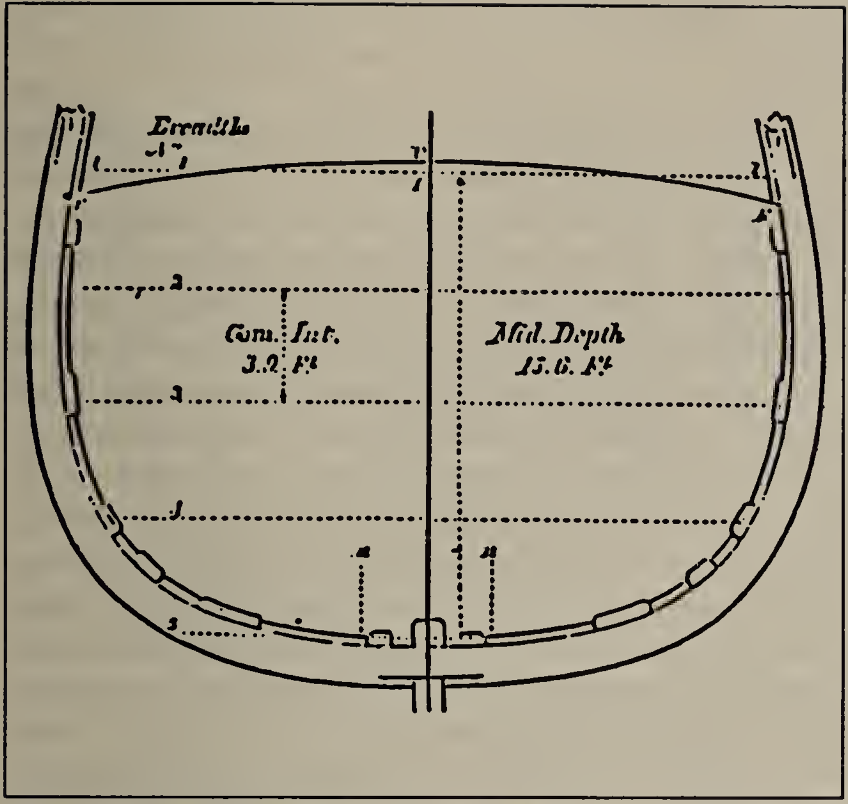

Figure 2: Midship area showing measurement of breadths, from I. R. Butts, *Merchant's and Shipmaster's Manual and Shipbuilder's and Sailmaker's Assistant* (Boston, 1873).

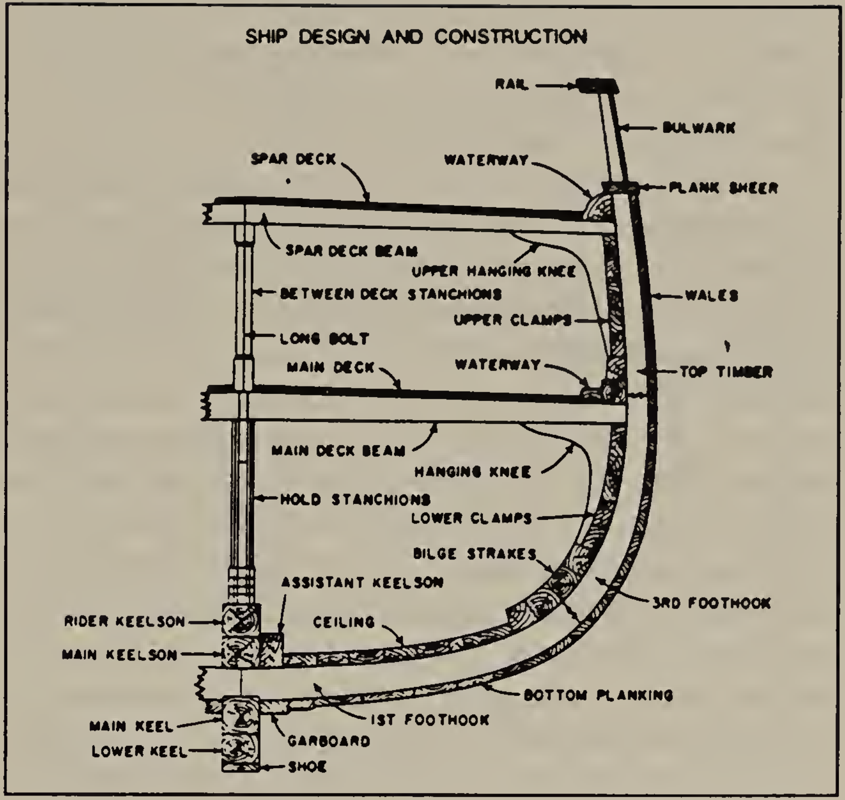

Figure 3: A more modern view of a wooden sailing ship midship section, from Robert Taggert, ed., *Ship Design and Construction* (Society of Naval Architects and Marine Engineers, 1980).

the same as the above-deck heights of her forward house and cabin. The second admeasurement, made for the purpose of deducting crew space, shows the headroom in the houses to be 7.0 feet. Deducting from this the 2.8 feet above deck, plus 0.2 feet for the thickness of the poop deck, leaves a tween-deck height of 4.0 feet. This was more typical of the period. Despite the new data from the second admeasurement, the original error was never corrected, resulting in a 30-ton reduction in her measured tonnage.

Table 2 on page 122 is a simplified list of exemptions and deductions applicable to wooden vessels of the type under study, based on the Code of Federal Regulations 46, Part 69, as revised 1 October 1973. Despite the apparent anachronism, these regulations agree closely with data for vessels measured shortly after the revision of 1882.

The Measurer's Work

The first step in measuring a vessel was to locate the extremities of the tonnage length. Written rules attempted to describe how this should be done, but in the case of wooden vessels the true end points were usually unreachable, and because most ships were built from models, no plans existed from which they might have been developed. No doubt communication took place between the custom house districts and headquarters regarding controversial details of admeasurement, but no record of these has been found, and the local measurer seems to have been ingenious in finding his own solutions, which might differ from those in another district. Dimensions and notes, once entered on a certificate, were seldom altered, and some strange inconsistencies have been found entombed in the records. Today tonnages are developed from the vessel's working drawings.

I. R. Butt's *Merchant's and Shipmaster's Manual and Shipbuilder's and Sailmaker's Assistant* (1873) describes the method of measuring as it was prescribed in the 1870s. His instructions are excerpted in the Appendix (see page 140), and figure 2 (above left) illustrates the system for measuring the cross-section of a ship.

From study of the relation between models, tonnage measurements, and other references, it is apparent that measurers found practical solutions to their problems, particularly regarding tonnage length. The contemporary rules stated that the length at the tonnage deck was to be taken by stretching a line on the upper surface of the deck and then transferring to the space below for division into the prescribed number of sections.[15] This method probably reflected the intent of earlier rules to permit tonnage to be measured even when a vessel was afloat and with her hold filled with cargo, but it was nearly impossible to accomplish on most U.S. sailing vessels, since the bowsprit covered the forward terminus and the deck was covered with obstructions. Later rules prescribed that length be measured on the underside of the tonnage deck, but here, again, the written directions for measurement show that the rules were difficult to understand and the physical points difficult or impossible to reach.

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[15] I. R. Butts, *The Merchant's and Shipmaster's Manual and Shipbuilder's and Sailmaker's Assistant* (Boston: I. R. Butts and Co., 1873). See basic computation of volume (pp. 16-19), and "General Directions for Taking the Measurements of Vessels" (pp. 37-39, reprinted as the Appendix to this article). See also figure 2 above left.

Since the cross-sectional areas measured at the end points normally have zero value in the actual computation of under-deck tonnage, the measurers probably did not take their location very seriously. Even on a square-ended hull, whose end stations had measurable cross sections, the Simpson's Rule multiplier for calculating volume is only one, as compared to four and two for the intermediate sections. The certificate for the *Emma L. Cottingham* (see figure 4 on pages 126 and 127) provides an example.

It was easier to handle all length and subdivision measurements in the cargo hold of a typical sailing vessel than from above deck, and it therefore seems logical to assume that the measurers based the admeasurement on the maximum length in which cargo could be carried. Compared to other alternatives, it would be relatively easy to measure from a selected termination at one end to an adjacent centerline stanchion, repeat this at the opposite end of the vessel, and then add the measurement connecting the referenced stanchions.

Figure 9 on page 134 illustrates the author's interpretation of the apparatus and methods used in measuring. The equipment was probably copied from that used in Great Britain. Measurements were originally taken with fabric tape, which required careful maintenance and frequent comparison with a standard reference.[16] Howard Chapelle states that steel tapes became available in the 1880s.[17]

The various instructions describe "stanchions" and "lift rods" — two special implements required for admeasurement — in rather formal terms, but it is very possible that these tools were improvised on the job. They are shown in use in figure 9. The stanchion was simply an adjustable pole that could have consisted of two pieces of straight wood held together with clamps. The lift rod was a stick of appropriate length with a fork formed at its top by fastening short pieces on each side or by notching the wood.

Possibly the best published description of equipment and procedure appears in *Measurement of Vessels for the Panama Canal,* which presents the methods of determining tonnage in Great Britain, the United States, and Germany in 1913. The illustrations are quite clear and cover a number of conditions that must have puzzled earlier measurers.

DRAFTING A COMPLETE SET OF LINES FROM TONNAGE MEASUREMENTS

Tonnage measurements provide the means for making a very reasonable reconstruction of the form of a vessel, especially if other sources can provide some guidance on the contours of the sheer and the end profiles. The best supplemental information comes from builders' models, which usually represent the complete form, to the outside of the framing (or inside of the planking), contrary to the practice of modern yacht designers, who rely on the builder to make the transition from the outside of the "skin." Whenever possible, both model and tonnage measurements should be used to produce the most accurate representation of a given vessel for which reliable plans are not available. In the absence of a model, reference to a photograph or trusted painting, or comparison with a model or pictorial representation of a similar vessel built by the same builder or in the same region and period, can assist in reconstruction of the profile. Profile characteristics adhered with remarkable consistency to established fashions; for instance, the rakes of the lower part of the stem and of the transom were almost standard on South Jersey coasters during the late nineteenth century. All had transom sterns, flat or nearly flat, and usually described on documentation as "elliptic." If no model or plan is available, the lines can be drawn entirely from a tonnage admeasurement, supplemented by pictorial information. The first step in drafting a tonnage plan is to lay down on paper a grid consisting of centerlines, straight base lines representing the inside of the ceiling, and station lines, the latter being spaced on the sheer and half-breadth plans as recorded on the tonnage admeasurement. It is best to place the half-sections in a row above the sheer plan and separated from each other rather than overlapping as in a conventional body plan, in order to expose fully their construction lines. The half-breadth plan can be located below the sheer plan, as is usual practice.

A preliminary sheer line is now drawn through the highest points on each section as measured above the previously drawn base line. In most cases this line will droop at one or both ends, since the recorded height at such points was measured above ceiling or deadwood that was higher than the straight baseline. The heights of the majority of the sections will usually generate a fair curve, having been easy to measure on the vessel, and if a good wooden spline is fixed on four or more points near mid-length, its natural curve, with slight adjustment at the ends, will approach the true sheer line. Comparison with the sheer taken from the best available pictorial reference will usually confirm this.

The next step is to draw half of each tonnage section on the grid above the sheer plan, with the total heights of those sections where the sheer was faired being measured down from the sheerline rather than up from the straight base line. Each section is drawn using its tabulated elevations and corresponding half-breadths.

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[16] Emory R. Johnson, *Measurement of Vessels for the Panama Canal* (Washington, D.C.: Government Printing Office, 1913), 305, 306.

[17] Chapelle, *The National Watercraft Collection,* 6.

In order to relate the tonnage measurements to the external form of the hull, it is now necessary to relate the inside of the ceiling (the low point of the majority of tonnage heights) to the vessel's molded line of keel. This height is equal to the thickness of the ceiling plus the molded depth of the frame floors, and it can be developed with reasonable accuracy from the construction rules of the American Shipmasters' Association. In the case of the *Emma L. Cottingham,* the distance from the inside of the ceiling to the inside of the keel rabbet was assumed to be 17 inches, representing 3½ inches of ceiling plus 13½ inches of frame floor. The molded line of keel then becomes the design base line and a set of waterlines is drawn above it on the sheer and section plans. The waterlines can be spaced to correspond to those of a model or plan. Buttock lines should also be introduced. A set of internal lines, complete except for endings, can now be drawn. The lines, faired longitudinally, will terminate one section space from each end of the tonnage length.

In the bow, the waterlines project forward of section two to an intersection with the assumed stem half-siding, in order to develop a reasonable profile. At the stern, the lower waterlines help to locate the stern post, but buttocks are more helpful in positioning the base of the transom. In the case of the vessels covered by this study, the forward terminus of the tonnage length usually appears to be the aft side of the upper breast hook or another object obscuring the statutory point — generally the foremost limit of cargo stowage. At the stern, it commonly appears to be the inner or outer stern post, the former being the more visible choice. It should be noted that here the location of the endings is determined by logic and that statutory definition is ignored.

With bow and stern profiles roughed-in, decks in addition to the tonnage deck should be drawn. When drawing a true double-decker, with two continuous decks, the lower deck will be below that defined by the tonnage depths from the certificate. Its height on the *Gertrude Abbott,* for example, was determined by subtracting the height of the "head of cabin" from the height of the "crew space, after house." A poop deck will be above the tonnage deck and its height recorded on the tonnage admeasurement certificate.

It is now advisable to check the registered length against the profile already roughly outlined. Its aft terminus should be, and almost invariably will be, the aft side of the main stern post. Its forward terminus should be the stem rabbet at the tonnage deck, but on some vessels with single decks or long poops it has been found to be at a short forward well deck several feet higher than the tonnage deck. However, it may be impossible to reconcile the tonnage and register lengths, in which case the tonnage dimensions and pictorial evidence must be relied upon to finish the profile.

The rest of the job consists of perfecting the endings and overall fairing. Some obvious measurer's errors are usually found. All large wooden vessels have "thick" strakes of ceiling placed where added strength was required, but measurers were instructed to reduce these to an "average" thickness when measuring breadths. One may question the accuracy with which this was done, but the assumption of an average thickness greatly simplifies the reconstruction. The result at this point is a tonnage plan, representing the internal form of the vessel.

In order to represent the ship in its finished form, it is now necessary to "flesh out" the tonnage plan to the outside of the planking, or to the outside of the framing if the plan is to be used to build a planked ship model. For this purpose one must establish the thicknesses of framing and planking. Builders' specifications for South Jersey vessels have not been found, but evidence indicates that scantling rules in accordance with those of the American Shipmasters' Association (ASA) and its predecessors either guided (or followed) local South Jersey practice, except in the case of frame spacing, which does not concern us here.[18] It has proven safe to use ASA scantlings in the reconstruction. Figure 3 on page 123 shows nomenclature of the structural components.

It was common practice in large vessels, all of which had hewn or sawn double frames, to taper the depth, or molding dimensions, of the frames uniformly from the keel to the covering board of the uppermost deck contributing to the strength of the vessel. Thus, according to ASA rules, the *Emma L. Cottingham* would have had floor depth of 13¼ inches at the keel, 5¾ inches molding at the top, and 9½ inches molding near the bilge. This might require minor adjustment to conform to the deadrise, or transverse slope of the bottom, which usually ranged between 6 inches and 12 inches in 12 feet on South Jersey coasters. If a positive reference is not found, this can be reasonably approximated in the process of fairing the sections and buttocks. Considering the minor inaccuracies inherent in the admeasurement process, it is usually satisfactory to adopt the same thicknesses for ceiling and planking, and in the case of the *Emma L. Cottingham* this would be about 3½ inches. The garboard strakes and wales would actually be thicker than this. Dimensions of the

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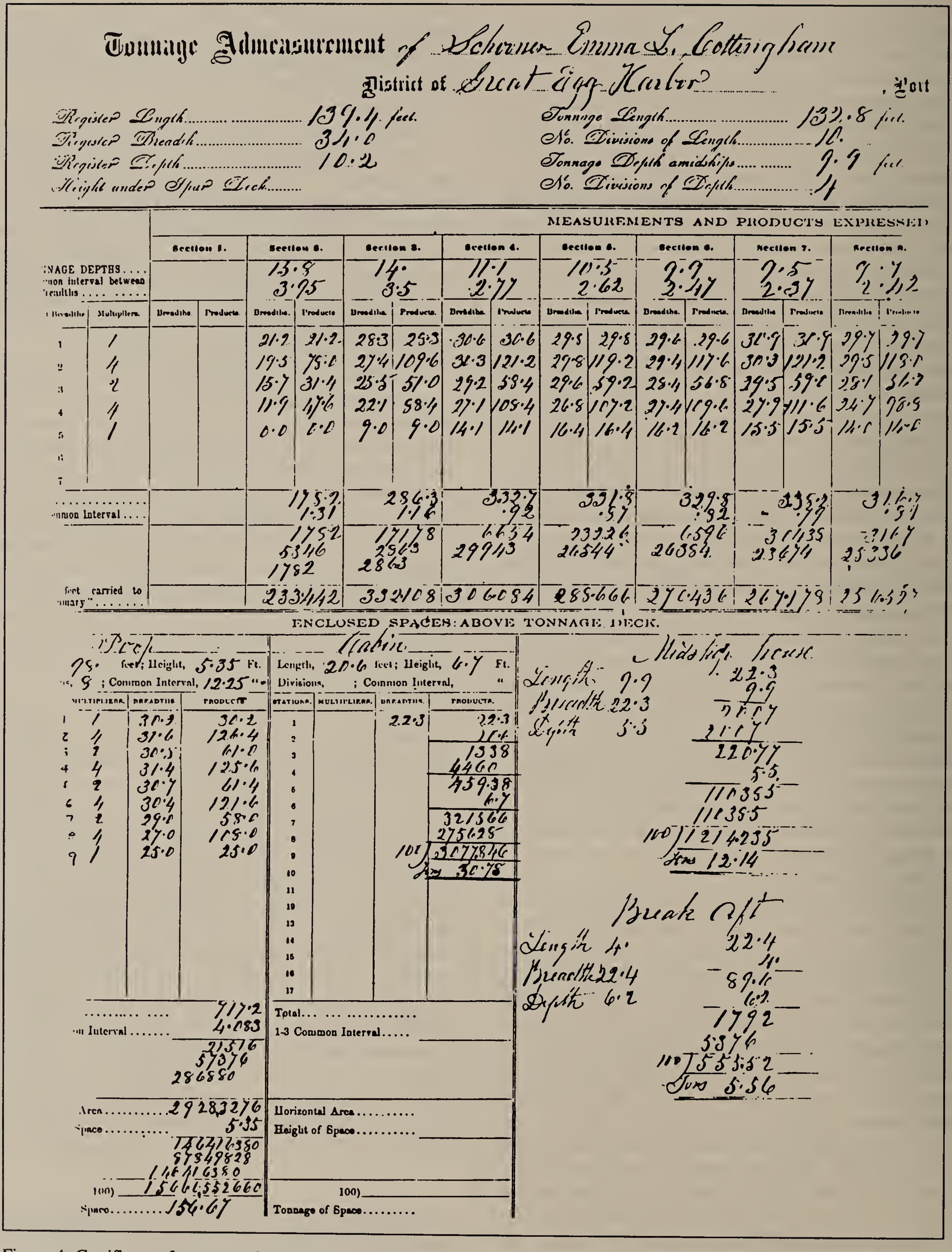
[18] Many South Jersey vessels received high classification ratings from the ASA, and many that were built within the spirit but outside the letter of the ASA certification system had long lives. Frame lines are nearly always found on a construction model.



Tonnage Admeasurement of Schooner Emma L. Cottingham

District of Great Egg Harbor , Port

Register Length	139.4 feet.	Tonnage Length	132.8 feet.
Register Breadth	34.0	No. Divisions of Length	10.
Register Depth	10.2	Tonnage Depth amidships	9.9 feet.
Height under Spar Deck		No. Divisions of Depth	4

MEASUREMENTS AND PRODUCTS EXPRESSED

		Section 1.		Section 2.		Section 3.		Section 4.		Section 5.		Section 6.		Section 7.		Section 8.	
NAGE DEPTHS.... mon interval between readths....				13.8 3.95		14. 3.5		11.1 2.77		10.5 2.62		9.9 2.47		9.5 2.37		9.7 2.42	
Breadths	Multipliers.	Breadths.	Products.	Breadths.	Products.	Breadths.	Products.	Breadths.	Products.	Breadths.	Products.	Breadths.	Products.	Breadths.	Products.	Breadths.	Products.
1	1			21.2	21.2	28.3	28.3	30.6	30.6	29.8	29.8	29.6	29.6	30.9	30.9	29.7	29.7
2	4			19.5	78.0	27.4	109.6	30.3	121.2	29.8	119.2	29.4	117.6	30.3	121.2	29.5	118.0
3	2			15.7	31.4	25.5	51.0	29.2	58.4	29.6	59.2	28.4	56.8	29.5	59.0	28.1	56.2
4	4			11.9	47.6	22.1	88.4	27.1	108.4	26.8	107.2	27.4	109.6	27.9	111.6	24.7	98.8
5	1			0.0	0.0	9.0	9.0	14.1	14.1	16.4	16.4	16.2	16.2	15.5	15.5	14.0	14.0
6																	
7																	
.... mmon Interval....					175.2 1.31		286.3 1.16		332.7 .92		331.8 .57		329.8 .82		335.2 .77		316.7 .91
					1752 5346 1782		17178 2863 2863		6654 29943		23226 26544		6596 26384		31435 23674		3167 25336
feet carried to mary".......					233442		332108		306084		288.666		270.436		267.179		251.55

ENCLOSED SPACES: ABOVE TONNAGE DECK.

Poop

75. feet; Height, 5.35 Ft.

ns, 9 ; Common Interval, 12.25 "

	MULTIPLIERS.	BREADTHS.	PRODUCTS.
1	1	30.2	30.2
2	4	31.6	126.4
3	2	30.5	61.0
4	4	31.4	125.6
5	2	30.7	61.4
6	4	30.4	121.6
7	2	29.0	58.0
8	4	27.0	108.0
9	1	25.0	25.0

....	717.2
n Interval.......	4.083
	21516 57376 286880
Area...........	29283276
Space...........	5.35
	146416380 87849828 146416380
100)	15666552660
Space.........	156.67

Cabin

Length, 20.6 feet; Height, 6.7 Ft.

Divisions, ; Common Interval, "

STATIONS.	MULTIPLIERS.	BREADTHS.	PRODUCTS.
1		22.3	22.3
2			20.6
3			1338
4			4460
5			459.38
6			6.7
7			321566
8			275628
9		100)	3077846
10			Tons 30.78
11			
12			
13			
14			
15			
16			
17			

Total...	
1-3 Common Interval.....	
Horizontal Area..........	
Height of Space..........	
100)	
Tonnage of Space.........	

Midship House

Length 9.9
Breadth 22.3
Depth 5.5

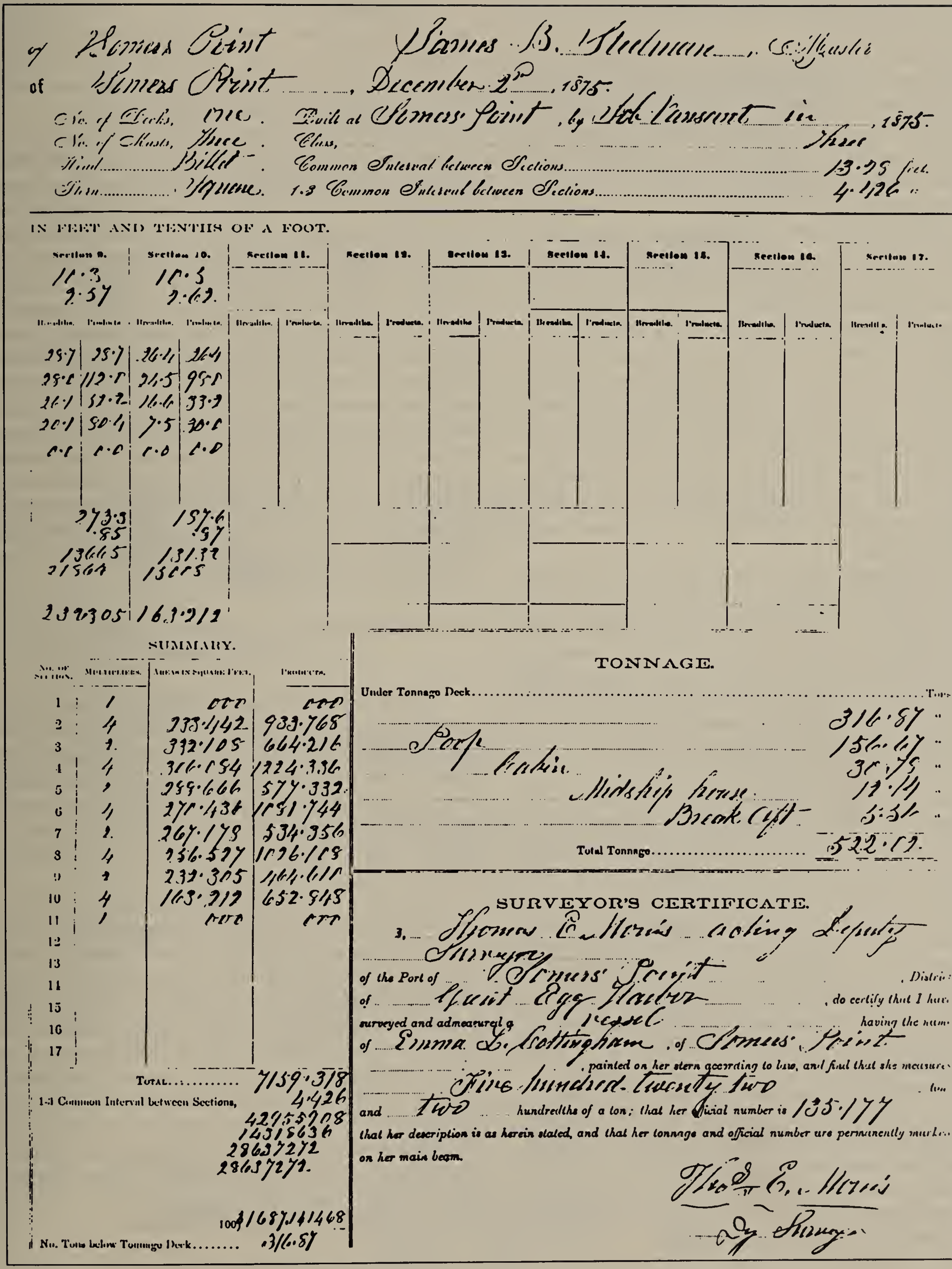
22.3
9.9
2007
2007
220.77
5.5
110385
110385
100) 1214235
Tons 12.14

Break Aft

Length 4.
Breadth 22.4
Depth 6.2

22.4
4.
89.6
6.2
1792
5376
100) 55552
Tons 5.56

Figure 4: Certificate of tonnage admeasurement of the tern schooner *Emma L. Cottingham,* Somers Point, New Jersey,



of Somers Point James B. Steelman, Master

of Somers Point, December 2d, 1875.

No. of Decks, one. Built at Somers Point, by Jeh. Vansant in 1875.
No. of Masts, three. Class, Three
Head Billet. Common Interval between Sections 13·28 feet.
Stern Square. 1-3 Common Interval between Sections 4·426 "

IN FEET AND TENTHS OF A FOOT.

Section 9.		Section 10.		Section 11.		Section 12.		Section 13.		Section 14.		Section 15.		Section 16.		Section 17.	
11·3 9·57		10·3 9·63															
Breadths.	Products.	Breadths.	Products.	Breadths.	Products.	Breadths.	Products.	Breadths.	Products.	Breadths.	Products.	Breadths.	Products.	Breadths.	Products.	Breadths.	Products.
28·7	28·7	26·4	26·4														
28·0	112·0	24·5	98·0														
26·1	52·2	16·6	33·2														
20·1	80·4	7·5	30·0														
0·0	0·0	0·0	0·0														
	273·3 ·85 13665 21864		187·6 ·87 13132 15008														
	232305		163·212														

SUMMARY.

No. of Section.	Multipliers.	Areas in Square Feet.	Products.
1	1	000	000
2	4	233·442	933·768
3	2.	332·108	664·216
4	4	306·084	1224·336
5	2	288·666	577·332
6	4	270·436	1081·744
7	2.	267·178	534·356
8	4	256·527	1026·108
9	2	232·305	464·610
10	4	163·212	652·848
11	1	000	000
12			
13			
14			
15			
16			
17			
		Total	7159·318
		1-3 Common Interval between Sections,	4·426 42955908 14318636 28637272 28637272.
			100)3168714146 8
		No. Tons below Tonnage Deck	316·87

TONNAGE.

	Tons.
Under Tonnage Deck	316·87 "
Poop	156·67 "
Cabin	30·79 "
Midship house	12·35 "
Break Aft	5·34 "
Total Tonnage	522·02.

SURVEYOR'S CERTIFICATE.

I, Thomas E. Morris acting Deputy Surveyor of the Port of Somers' Point, District of Great Egg Harbor, do certify that I have surveyed and admeasured a vessel having the name of Emma L. Cottingham, of Somers' Point, painted on her stern according to law, and find that she measures Five hundred twenty two tons and two hundredths of a ton; that her official number is 135·177 that her description is as herein stated, and that her tonnage and official number are permanently marked on her main beam.

Thos. E. Morris
Dy Surveyor

2 December 1875. Illustration courtesy of the Philadelphia Maritime Museum, Philadelphia, Pennsylvania.

stem, stern post, and all other members are also taken from the ASA rules.

Having accumulated the above information, it is now possible to fill out each tonnage section to either the inside or outside of the planking, as desired. The camber, or round, of the deck must be approximated, and was usually about three-eighths inch per foot of half-breadth (six inches in sixteen feet). Figure 2 on page 123 shows that the tonnage height at each section is measured to a point one-third of the "round" or camber from the top; thus, in the case of six-inch camber, the true height of the vessel's deck amidships would be two inches higher than the tonnage measurement. Measurers were advised to use the same dimension at all sections except the ends.[19] The height of the deck at each side is derived by subtracting the distance down to the camber line at the side of the vessel from the centerline height. For greatest accuracy, the drop in height should be plotted on the scale of the drawing horizontally and on a larger scale vertically, then measured and transferred back to the scale of the drawing. At this stage, one has all of the elements necessary to complete the draft of a set of lines to the inside or outside of the planking.

If the reconstruction is being developed in association with a model, the model's lines can be taken off with great accuracy, working on a true plane surface with simple equipment. Most models were built in laminations, and it is wise to separate a few in hope of finding helpful notes. Disassembly often incurs damage, however. Offsets should be taken at the top surface of each lamination, on the builder's frame lines, wherever possible.

Models may be flawed by inaccuracies, the most common of which are caused by wood shrinkage or damage. The first step is to correct half-breadths for shrinkage. The percentage of shrinkage is found by comparing a half-breadth measurement written on the model with the scaled dimension at the same location. Several should be averaged. A less reliable method is to compare the greatest breadth of the model with the greatest tonnage breadth plus the thicknesses of ceiling and framing. On models 100 to 120 years of age and made of pine or cedar, shrinkage has been found to be between 2.5 and 3.5 percent. It is easy to correct each offset from the model with a pocket calculator set to a constant multiplier.

Vertical shrinkage of models is nearly negligible. The thickness of the laminations usually does not have to be measured in any case, since each represents a known height. This leaves only the short distance between the uppermost waterplane and the sheer to be measured, and this can be more reliably derived from the sheer that has been generated from the tonnage heights.

No shrinkage occurs in the length of models, although deviations have been noted that are the result of builders' intentional alterations. Such changes can usually be found by matching the lines of a model's bow and stern to the lines developed from tonnage admeasurement.

In 1977, Norman N. Rubin made a detailed study of the builders' models of small Chesapeake Bay craft (most under seventy feet), and he encountered many inconsistent dimensions.[20] The variations between model lengths, breadths, and depths and official registered dimensions were sufficiently confusing to discourage reliance on builders' models. In addition to variations in plank thickness, errors in construction, errors in measuring devices, and the rounding of decimal fractions, Rubin considered shrinkage. He found apparent shrinkage factors as high as 10 percent and seemed to feel that a 4.5 percent error was reasonably acceptable. It is possible that simple "dead-rise" hulls departed from their model to accommodate available keel or other construction timber, but the accuracy of more sophisticated hull forms should not be denied out of hand. The use of tonnage admeasurement dimensions to detect the errors in registered and model dimensions would have probably reconciled most of the conflicts that Rubin encountered.

AN EXAMPLE OF RECONSTRUCTION: *GERTRUDE ABBOTT*

Figures 5 and 6 on page 129 (opposite) illustrate the use of tonnage admeasurements to identify a model in the John Dubois Maritime Museum of the Cumberland County Historical Society, Greenwich, New Jersey. The model was said to represent the tern *Gertrude Abbott,* built at Dennisville, New Jersey in 1882. However, its dimensions could not be reconciled with those in her licenses or public records.

To test the identification of the model, the *Abbott*'s internal three-dimensional form was reconstructed on the basis of her tonnage admeasurement. Waterlines corresponding to those on the model were drawn in, and this draft was superimposed on the lines of the model. The bow and stern matched closely, but the length of the vessel was two to three feet shorter than represented by the model, possibly to accommodate available keel timber. In spite of shortening during construction, it was also proven that the true registered length was about 11.3 feet greater than recorded. Figure 6 shows model sections superimposed on the *Gertrude Abbott*'s tonnage sections. Whereas there are minor deviations, this comparison proves that the model is that of the *Abbott.*

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[19] Butts, *Merchant's and Shipmaster's Manual,* 38.

[20] Norman N. Rubin, "Variances in Dimensions of Half-Models," *The American Neptune* 37 (July 1977): 164-173.

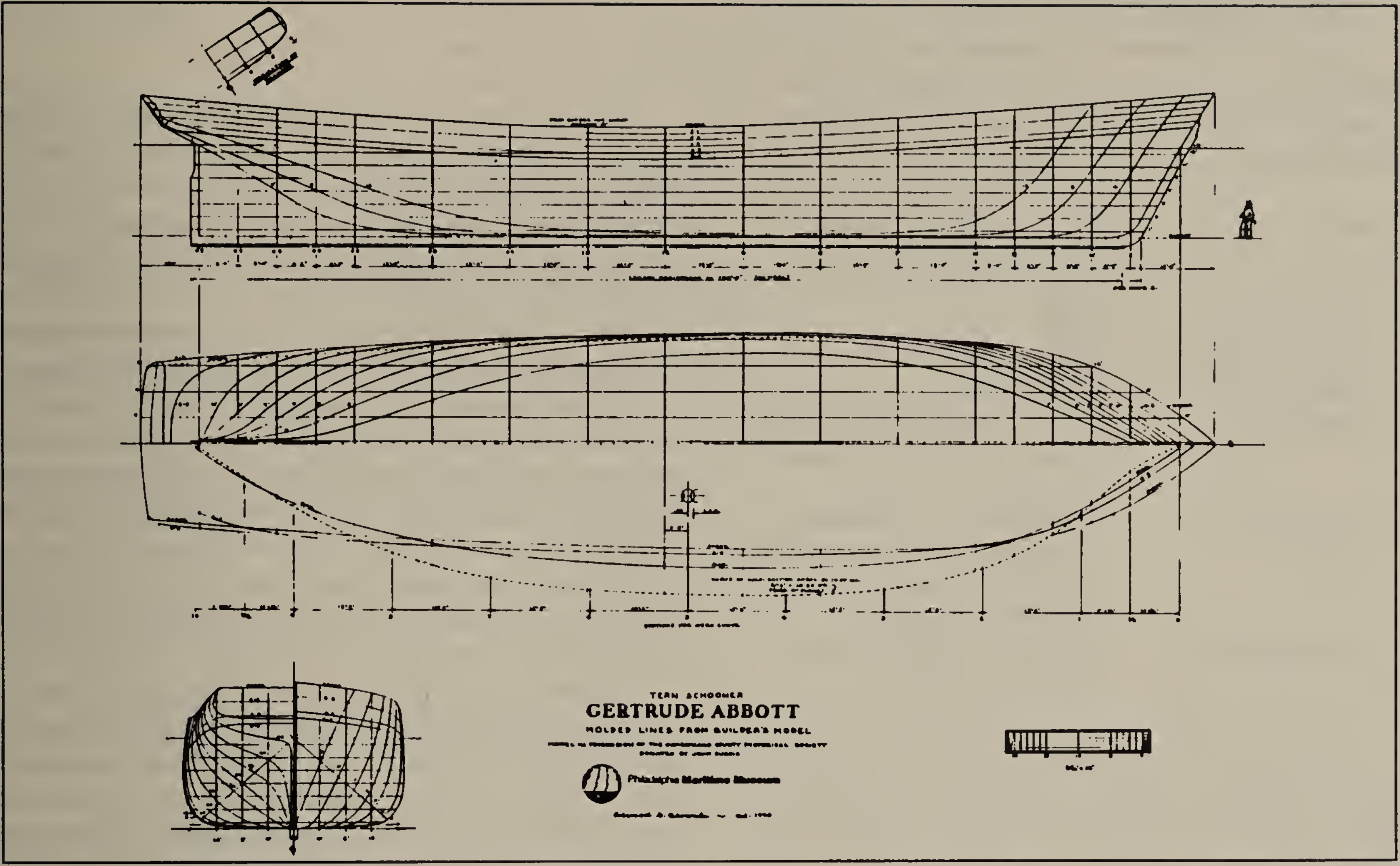
TERN SCHOONER
GERTRUDE ABBOTT
MOLDED LINES FROM BUILDER'S MODEL
Philadelphia Maritime Museum

Figure 5: Molded lines of the tern *Gertrude Abbot,* derived from a model in the collection of the Cumberland County Historical Society, Greenwich, New Jersey.

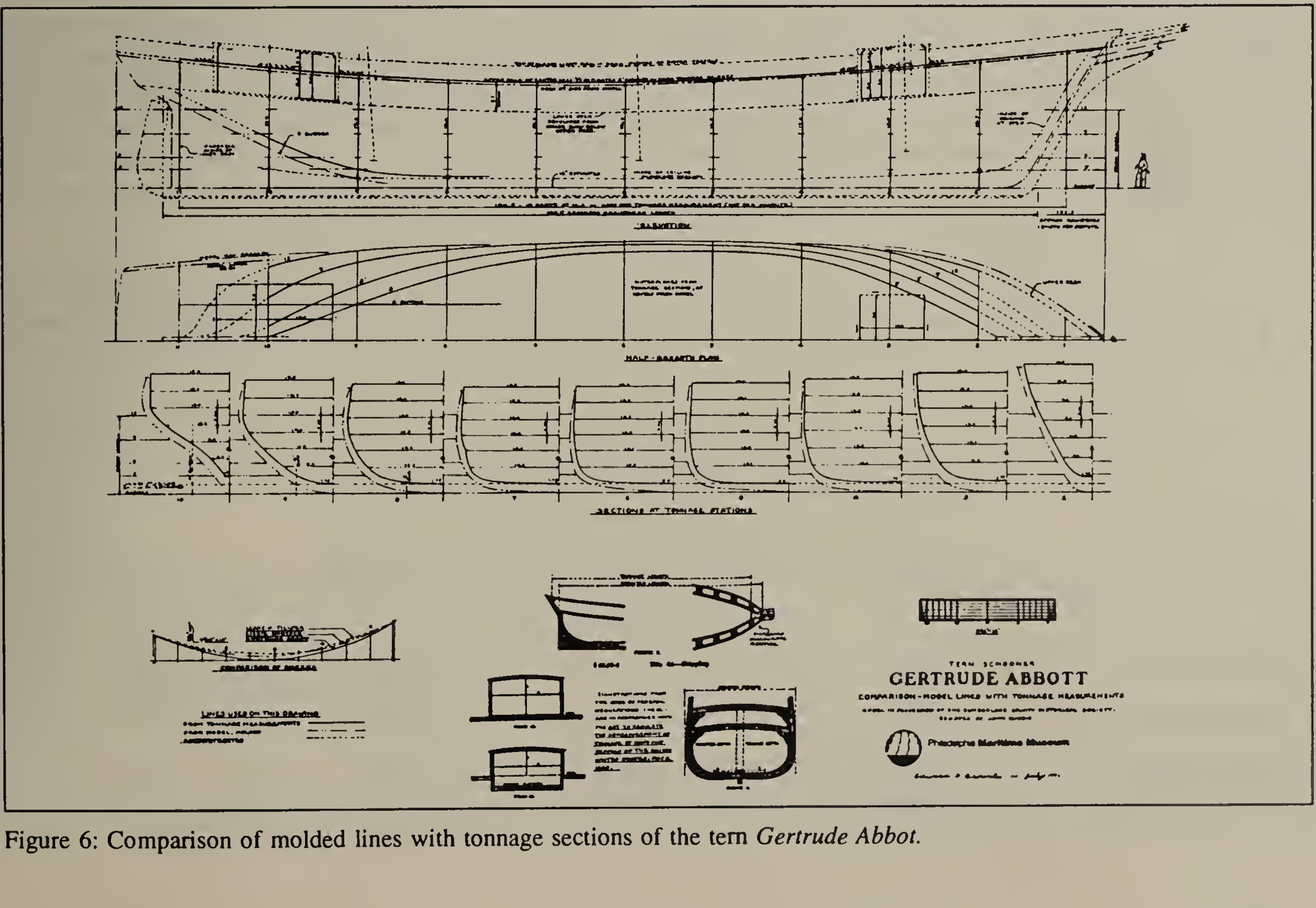
ELEVATION
HALF-BREADTH PLAN
SECTIONS AT TONNAGE STATIONS
TERN SCHOONER
GERTRUDE ABBOTT
COMPARISON - MODEL LINES WITH TONNAGE MEASUREMENTS
Philadelphia Maritime Museum

Figure 6: Comparison of molded lines with tonnage sections of the tern *Gertrude Abbot.*

The following are the *Abbott*'s particulars, taken from the *American Shipmaster's Association Record,* her Philadelphia tonnage admeasurement certificate (dated 14 November 1882), and her first and last Certificates of Enrollment:

Built	October, 1882, Dennisville, NJ, by R.S. Leaming
Official Number	85,755
Signal Letters	JWRP
Register Dimensions	144.0' x 35.0' x 16.5'
Gross Tonnage	594; Net 565
Construction	2 decks; centerboard; oak, gum, yellow pine, galvanized iron fastened
Hailing Port	Philadelphia, PA (entire life)
Masters	1884-1891, John Champion 1895-1896, Powell 1899-1900, P. Bugbee.
Managing Owners	1884-1896, John Champion; 1899, A.H. Doughty

The 4 April 1900 edition of the *New York Maritime Register* reported: "*Gertrude Abbott* (sc.) from Philadelphia for Jacksonville with coal, was totally wrecked on the jetties at the mouth of the St. John's River, Florida, night of March 27, crew safe."[21]

A further finding of this study was that the tonnage admeasurement of the terns *Isaac H. Tillyer* and *Lizzie Babcock* matched those of the *Gertrude Abbott* so closely as to prove their sisterhood. A detail on figure 6 (page 129) shows the comparison of their sheer lines, the *Babcock* having a twelve-inch greater midship tonnage depth than the *Abbott,* but all three having the same height at the ends. Table 3 below shows the recorded principal dimensions for these vessels.

EXAMPLE OF RECONSTRUCTION: ABBOTT SHIPYARD MODEL

Figure 7 on page 131 represents the only half model known to have survived from the Abbott Shipyard in Milford, Delaware. Its owner is Betty Harrington MacDonald, author of *Mispillion-built Sailing Vessels, 1716-1917* (1990), who wished to identify it with a specific vessel. The dimensions and form of the vessel pointed toward the Abbott-built two- and three-masted schooners described in her book[22] and shown in Table 4 opposite.

These vessels are interesting in that they were designed to navigate the very shallow tidal tributaries of the Delaware and Chesapeake bays. They exhibit the profiles of offshore vessels above water, but their hard bilges join nearly flat bottoms in very shallow hulls, permitting them to sail on the proverbial "heavy dew." They were the big sisters of the numerous smaller schooners and sloops once popular in the same area.

Figure 7 is a direct take-off of the model, which is laminated in alternating walnut and pine and is carefully made. Markings on the back appear to be locations of frames placed on 22½-inch centers. Some of the characteristics of the model matched those recorded in photographs of Mispillion schooners and encouraged an attempt at identification. The tonnage admeasurement certificates of the *Milliken, Lister, McNaughton,* and *Wimsatt* appeared to have characteristics closest to those of the model, and their interior lines were drawn. These were then compared with a set of internal lines developed from the model. Length was assumed to be adjustable, based on the study of the *Gertrude Abbott.* While all the vessels exhibited similar characteristics, none obviously fit the model (nor matched each other). All showed finer sterns and more

Table 3
Principal Dimensions of *Gertrude Abbot* and Sister Ships

	Built	Registered Dimensions	Tonnage Length	Gross Tons
Gertrude Abbott	1882	144.0' x 35.0' x 16.5'	146.0'	594
Lizzie Babcock	1883	145.0' x 35.0' x 17.2'	148.2'	589
Isaac H. Tillyer	1884	144.6' x 35.0' x 16.9'	146.2'	598

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[21] *New York Maritime Register,* 4 April 1900.

[22] Betty Harrington MacDonald, *Mispillion-built Sailing Vessels, 1761-1917* (Milford, DE: Milford Historical Society, 1990), 196-270.

Table 4
Possible Identities of Abbot Shipyard Model

	Built	Register Dimensions	Tonnage Length	Gross Tons
David Milliken	1877	99.0' x 28.0' x 6.8'	98.0'	145
Carrie Hall Lister	1878	103.0' x 27.5' x 7.1'	96.0'	142
James M. Hall	1879	95.0' x 27.0' x 5.5'	87.9'	87
J. C. McNaughton	1889	103.6' x 28.0' x 6.6'	103.6'	146
Josephine Wimsatt	1891	95.0' x 27.0' x 6.0'	105.7'	142
J. Lloyd Hawkridge	1905	89.6' x 26.6' x 6.4'	94.3'	122
Laforrest L. Simmons	1909	89.0' x 27.8' x 7.5'	—	132
Model (per statute)	—	93.0' x 28.0' x 6.1'	—	—

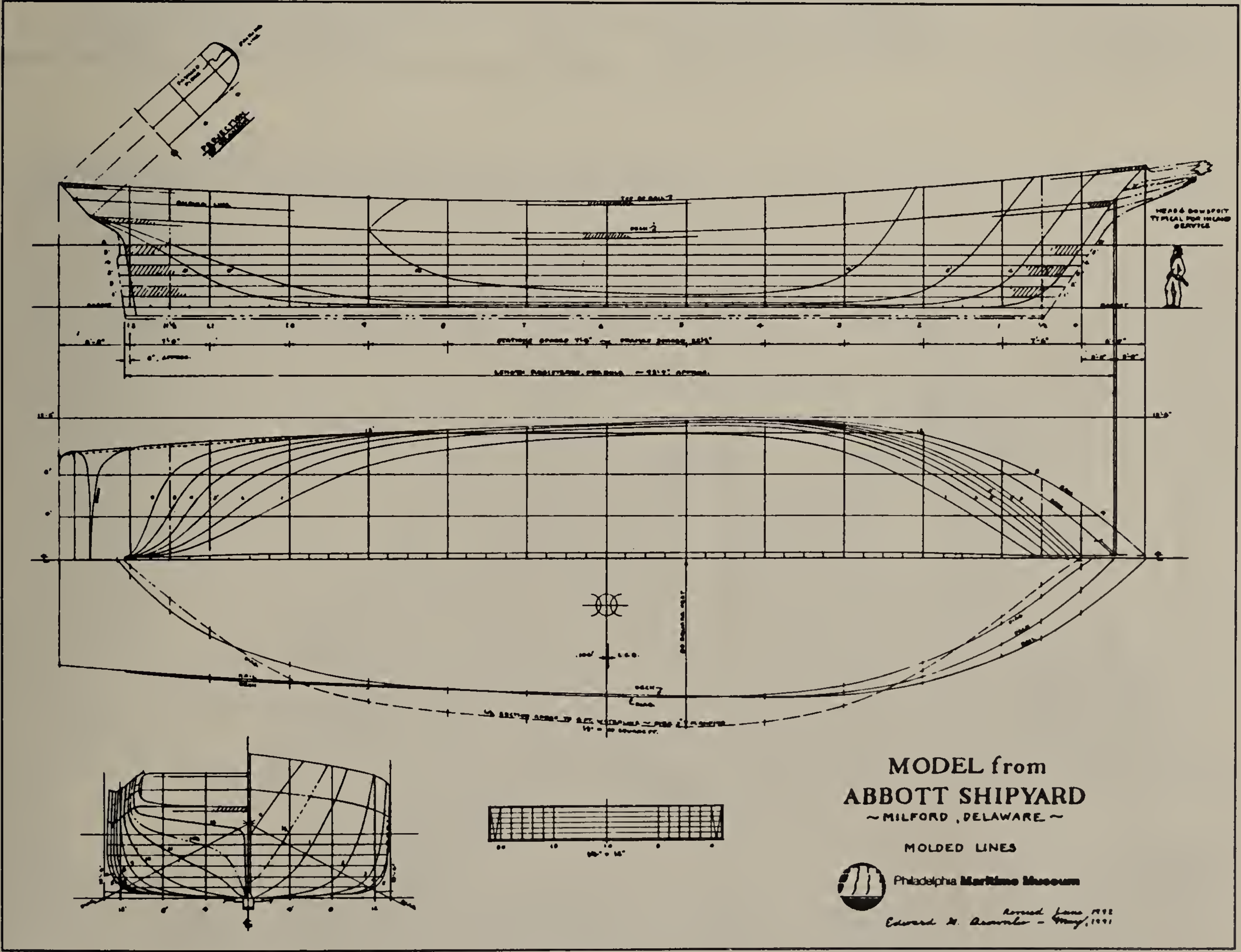


Figure 7: Molded lines derived from a model in the collection of Betty Harrington MacDonald, Alexandria, Virginia, said to be from the Abbot Shipyard of Milford, Delaware.

bow lines than those of the model, which suggested that this might be Abbott's first model of a desired type, which was abandoned in favor of later designs.

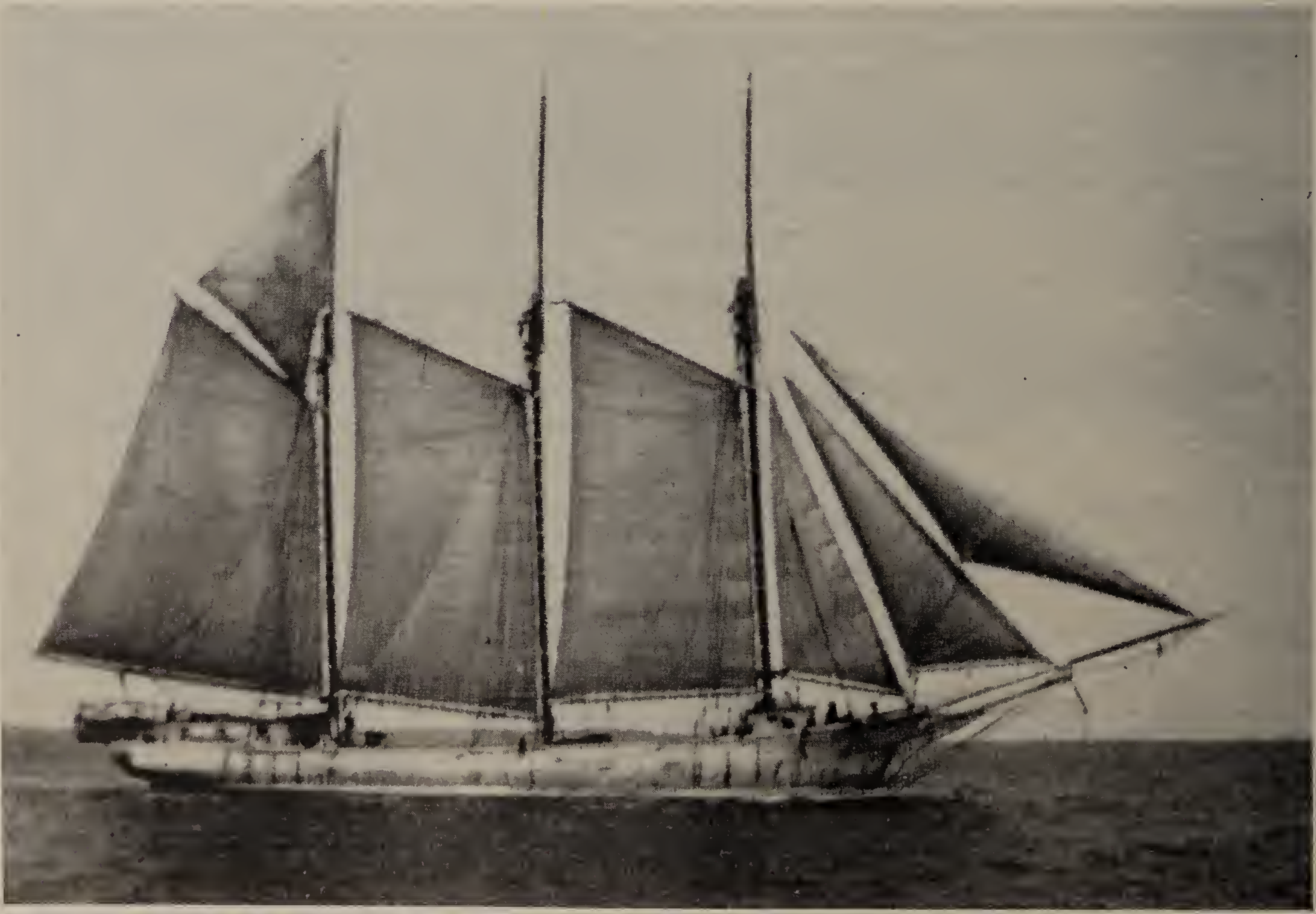
Figure 1 on page 120, representing the *David Milliken,* was drawn to facilitate the comparison of the model and the *Milliken*'s tonnage measurements. She was the first-built of the schooners considered. Certain details were added based on information pertaining to the *Josephine Wimsatt* to illustrate the character of Abbott's little three-masted schooners. It appears that the *Milliken*'s sheer was raised about eighteen inches higher than that of the model, forward, but remained the same aft. A peculiarity of the *Milliken*'s admeasurement is that whereas a small lazarette is included, obviously aft, no poop is measured, and the full height of the cabin is added to the underdeck tonnage. This suggests that she actually had a short poop extending to the forward side of the cabin, but that the space between sides of the cabin and the hull were exempted as crew space, being occupied mainly by berths. A raised deck would be required aft to give the helmsman vision over the cabin. A similar handling of a vessel known to have had a poop was found on the admeasurement of the *Katie D. Turner,* built at Absecon, New Jersey in 1874.

As in other studies, registered lengths and breadths of the Abbott schooners were found to be incompatible with the tonnage measurements. Sufficient information on the *Josephine Wimsatt* (pictured below) exists to permit a very reasonable reconstruction.

AN EXAMPLE OF RECONSTRUCTION: *BELLE HALLADAY*

Figures 8, 9, and 10 on pages 133 and 134 illustrate the reconstruction of a complete vessel using an admeasurement certificate and a photograph. The *Belle Halladay* was one of the many wooden sailing vessels built by the prolific Taylor and Mathis Shipyard on Cooper's Point, Camden, New Jersey. This small yard produced twenty-one coasting schooners between 1866 and 1875, of which fifteen were terns. In 1878 the company became Morris and Mathis and continued the production of sailing coasters into 1892. Only one model from this yard is known to exist, and no models from other contemporary Cooper's Point builders have been identified.

The lines, deck arrangement, and dimensions of the houses were developed from the vessel's tonnage



The tern *Josephine Wimsatt* off Sharp's Island, Chesapeake Bay, ca. 1933. Photo courtesy of Robert H. Burgess.

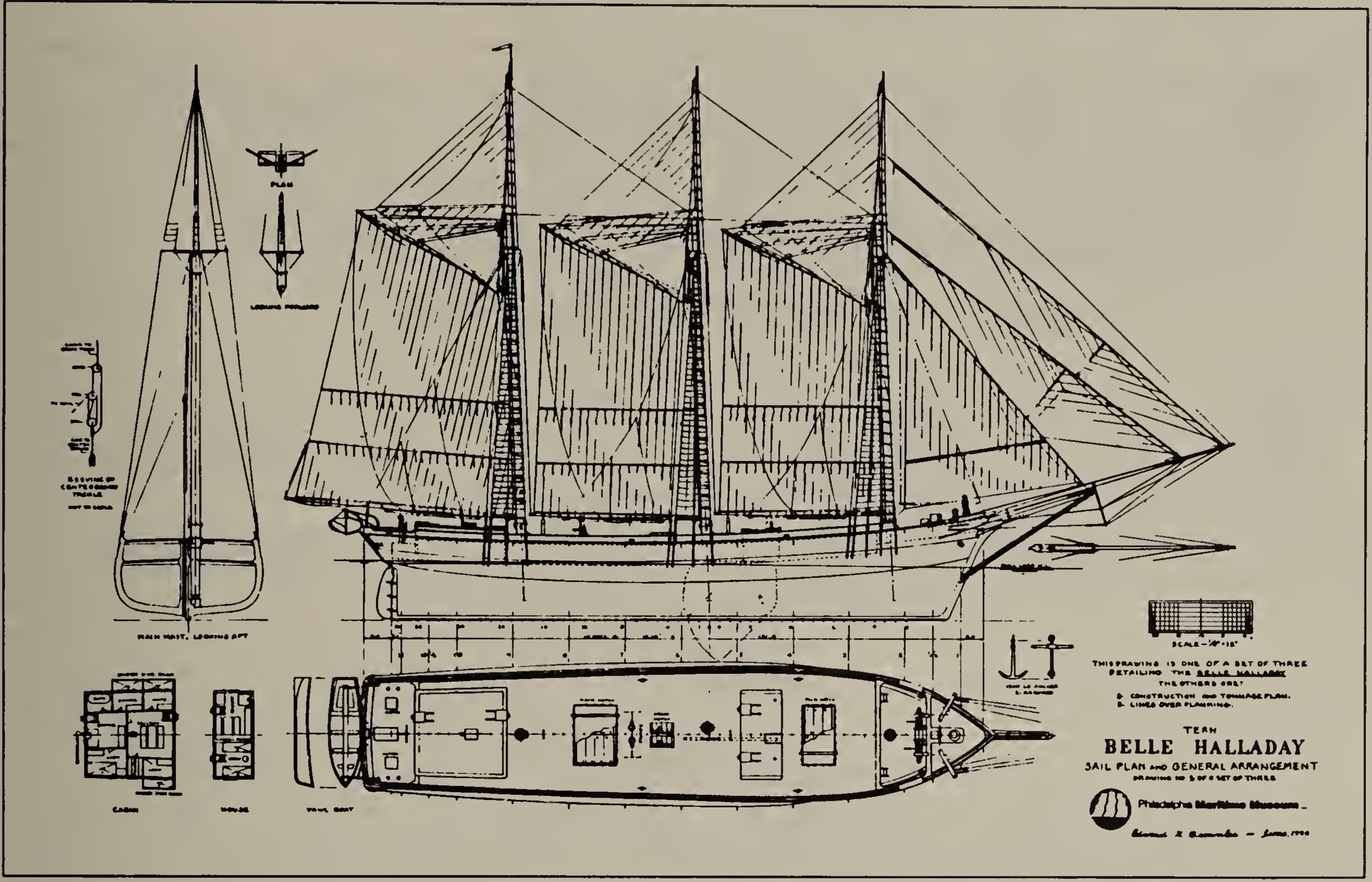

MAIN MAST, LOOKING AFT
SCALE
THIS DRAWING IS ONE OF A SET OF THREE DETAILING THE BELLE HALLADAY
TERN
BELLE HALLADAY
SAIL PLAN AND GENERAL ARRANGEMENT
Philadelphia Maritime Museum

Figure 8: Sail plan and general arrangement of the tern *Belle Halladay.*

admeasurment, which was found at the National Archives in Washington, D.C. The short dropped deck (or steering deck) aft of the cabin and the deeper well-deck forward were reconstructed on the basis of the tonnage depths, poop deck heights, and the lengths of the lazarette and poop. The steering deck is also apparent in the droop in the rail aft of the cabin seen in the old photograph on page 121, and a similar arrangement is recorded on the model of the *James Miller.*[23] The sunken steering deck was intended to increase head clearance under the spanker boom, but deficiency in this regard appears to have contributed to the *Halladay*'s loss by collision in 1910. The captain apparently lost control when struck by a boom tackle block while getting underway from anchor. This feature existed on other contemporary and earlier terns built in southern New Jersey.

The camera used to take the photo on page 121 was focused on the mainmast of the *Halladay,* which produced an almost planar view capable of yielding accurate measurements. The registered and tonnage lengths having been found to agree, the tonnage length was then used to construct a scale on the photograph. The recorded lengths of the deckhouses corroborated this scale, and it was then used to measure the profile, sail plan, and other details.

The photograph shows a very small boomed forestaysail tacked at the stem head. This appears to be a lately installed labor-saving device, and therefore a large loose-footed, bonnetted sail, tacked to the end of the bowsprit, was drawn as being more typical of schooners built prior to 1870. The photograph reveals no provisions for belaying halyards. The rail appears too low, and neither fife-rails nor shroud-mounted pin rails can be seen.

The internal arrangement and structure of the *Halladay* were reconstructed from visible or proven evidences and from a knowledge of contemporary practice. Contrary to the recommendation of the insurance underwriters, the *Halladay,* like many of the larger New Jersey-built vessels, carried her "center" board on the starboard side of the keel, with the mainmast to port. A popular belief in New Jersey was that this design was born out of the desire to evade the patent on conventional, center-mounted centerboards that was held by Jacocks Swain and his two sons of Cape May.[24] Little firsthand evidence of the complex construction of the off-center installation has

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[23] William S. Quincy, *The Three-masted Schooner* James Miller (Mystic, CT: Mystic Seaport Museum, 1986), 24.

[24] Lewis Townsend Stevens, *The History of Cape May County, New Jersey* (Cape May, NJ: Lewis T. Stevens, 1897), 229-232.

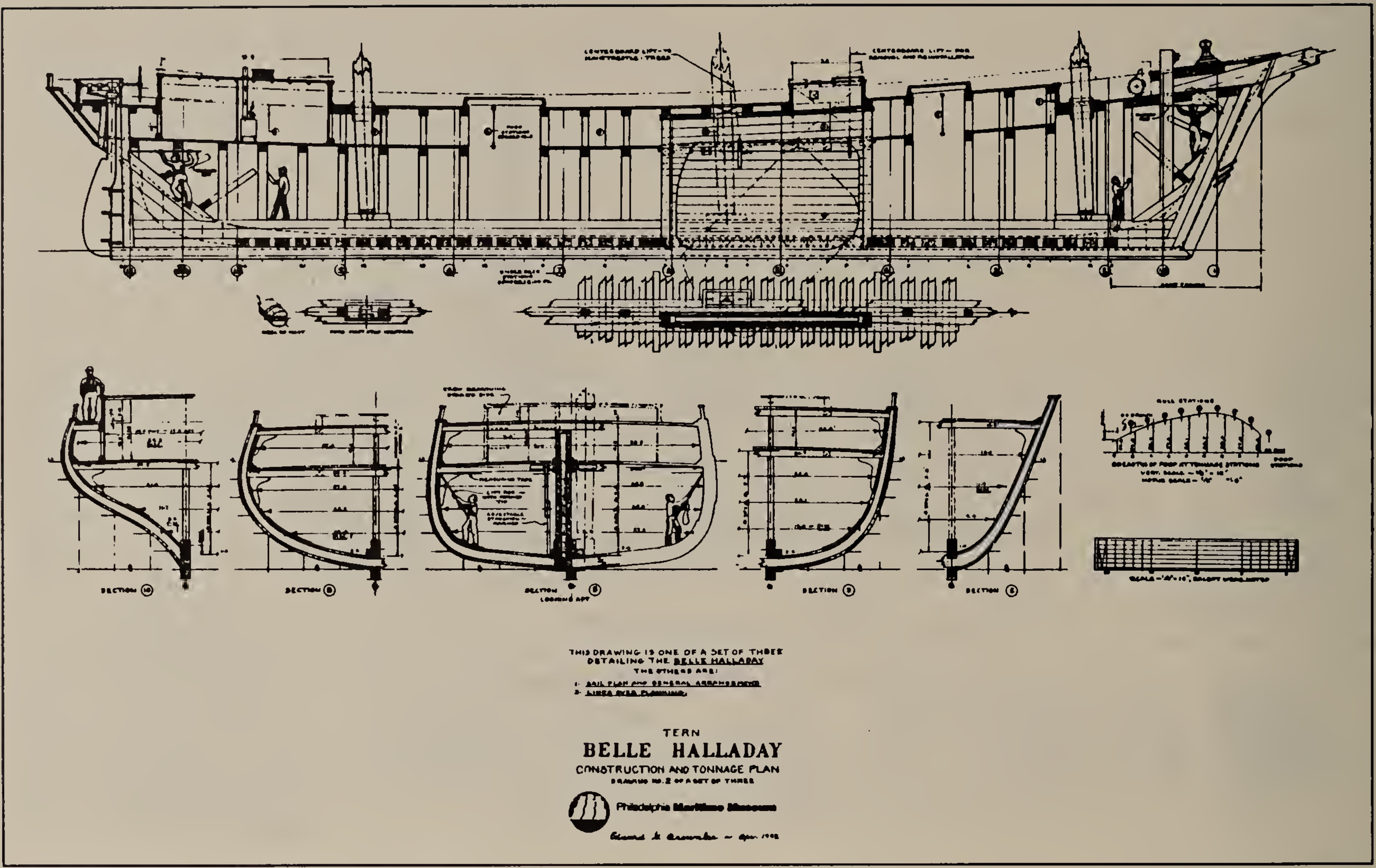
THIS DRAWING IS ONE OF A SET OF THREE DETAILING THE BELLE HALLADAY
TERN
BELLE HALLADAY
CONSTRUCTION AND TONNAGE PLAN
Philadelphia Maritime Museum
SECTION

Figure 9: Construction and tonnage plan of the tern *Belle Halladay,* showing measuring apparatus and method.

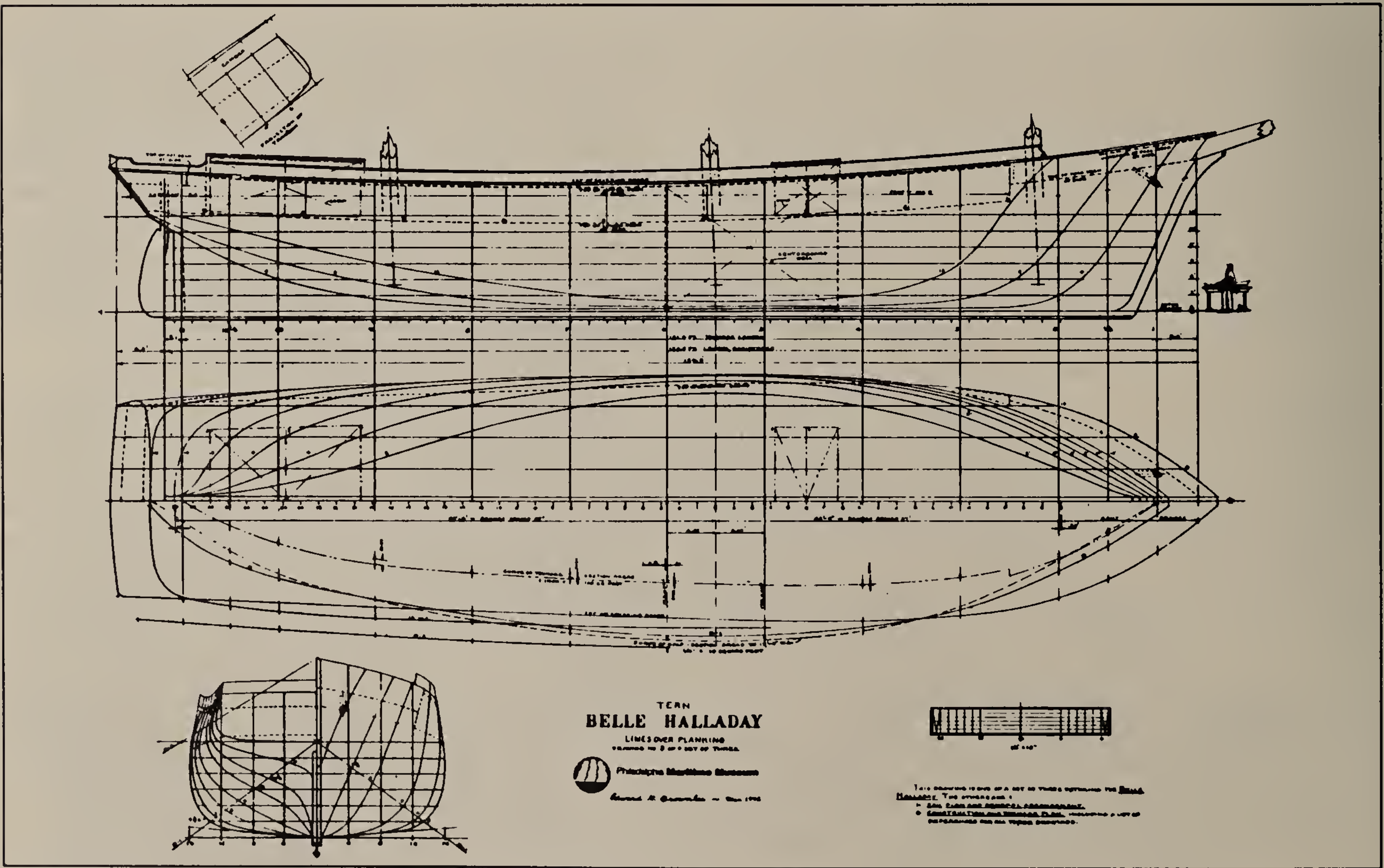

Figure 10: Lines over planking of the tern *Belle Halladay.*

survived, but the details have been pieced together from information on Delaware Bay oyster schooners assembled by the author in the 1930s and from the limitations posed by other structural components. (Figure 9 on page 134 shows the author's solution.) Henry N. Barkhausen's valuable information on Great Lakes centerboard practice largely confirms the author's interpretation of New Jersey continuation.[25] Furthermore, a photograph of a schooner in frame at Dennisville, New Jersey, showing frames left out of the starboard side where the centerboard was obviously to be installed, bolsters confidence in the proposed reconstruction.[26] The forward deckhouse seen in the *Halladay* photograph was obviously located over the forward part of the board, and the centerboard well certainly formed a partial centerline bulkhead (see photo on page 121 and figure 9 on page 134). The well-known marine historian Charles S. Morgan discovered that many contracts for construction of schooners built at Kennebunkport, Maine specified boards built to "Ketchum's patent." He obtained a copy of this, which is dated 10 July 1860 and issued to C. E. Ketchum and W. L. Hunt, of Port Jefferson, Long Island, New York. It shows in a simplified form all of the important relevant features of the author's construction plan of the *Belle Halladay,* figure 9 opposite, yet a diligent search by the author has disclosed no reference to it in New Jersey.[27]

Contemporary practice suggested a frame spacing of twenty-seven inches, and this was compatible with the locations of deck fixtures. The same spacing was used by Nehemiah Hayden on the *James Miller*[28] in 1854 and on the Morris and Mathis-built tern *Annie C. Grace* in 1880. Scantlings were based on ASA rules and Nehemiah Hayden's dimensions for the *James Miller.* Structural arrangement was developed from photographic evidence mentioned above and from plans of post-World War I schooners in the collection of the author and those reproduced in Charles Desmond's *Wooden Shipbuilding.*[29] These plans are the work of professional naval architects and draftsmen in 1917-18, but they reflect the methods of earlier, practical shipbuilders, many of whom were still working at that time.

The main deck rail on the *Halladay* seems too low for safety and would be condemned by the U.S. Coast Guard today. However, a study of models, paintings, and photographs indicates that it was in line with practice on many contemporary two-deck South Jersey schooners. In New Jersey, this lightly constructed type of rail was usually closed-in, no doubt being cheaper than the "fly rail" supported by turned stanchions that was common on New England vessels. Coal was a common, if not regular, cargo, and the low configuration may have more readily freed the deck of water in a seaway, a more important feature than retaining sailors. Single-deck schooners had high structural bulwarks on the weather deck.

Particulars of the *Belle Halladay,* from her first and last Certificates of Enrollment, *American Lloyd's Register,* the *American Shipmaster's Association Record,* and her Philadelphia admeasurement certificate, dated 26 June 1869, are as follows:

Built	June 1869 by Taylor and Mathis, Cooper's Point, Camden, NJ
Official number	2681
Signal letters	JGPS
Length, Register	128.5' as first enrolled
Tonnage Length	121.4'
Breadth, Register	31.0' as first enrolled
Depth, Register	9.6' as first enrolled (to lower deck)
Draft	12.0'
Gross Tons	355; Net 337
Construction	Medium Model; Single Deck; Half Poop; Centerboard; oak, galvanized iron fastened
Hailing Ports	New York; Jersey City, NJ; Taunton, MA; Boston, MA; Philadelphia, PA
Masters	King, Crawford, Burt, Nickerson, H.L. Fisher, J.F. Rutledge, Coleman, Brown
Managing Owners	J. Falkenburg & Co., S.H. Walker & Co., M. Nickerson & Co., J. Baker & Co. (per American Lloyd's), Atlantic & Pacific Co., Argonaut Lines, Davis Coal & Coke Co., C.J. Chadwick & Co., Inc.[30]

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[25] Henry N. Barkhausen, *Focusing on the Centerboard* (Manitowoc, WI: Manitowoc Maritime Museum, 1990), 22-24.

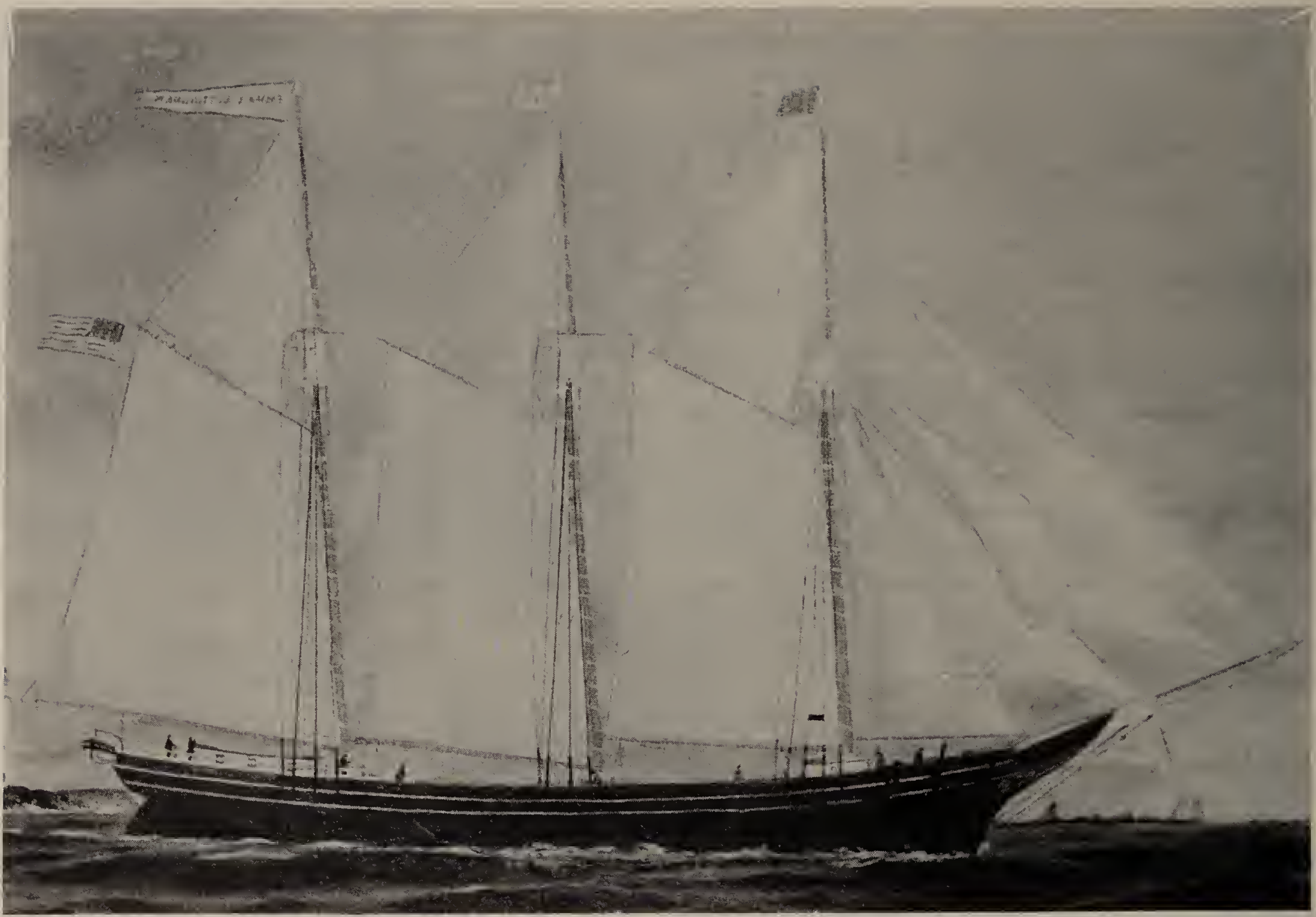
[26] Photographs of wooden three-masted schooners under construction at Dennisville, NJ (Cape May County Historical Society; Philadelphia Maritime Museum; New Jersey Historical Society, Yarnall Collection).

[27] A copy of the "Ketchum patent" covering the "off-center centerboard" was given to the author by Captain Douglas K. Lee of Rockland, Maine, and of the schooner *Heritage,* built by him and his wife, Captain Linda J. Lee.

[28] Quincy, *The Three-Masted Schooner* James Miller, 14-18.

[29] Charles Desmond, *Wooden Shipbuilding* (Vestal, NY: Vestal Press, 1984), 44-46, 50-53, 192, 196.

[30] The Western Maryland Railway 1906 annual Report included in its equipment list the schooners *William L. Walker* and *Belle Halladay.* The operating manager was apparently the Bowe's Coal and Coke Company of Philadelphia. Information from Harold A. William, *The Western Maryland Railway Story* (Baltimore, MD: privately printed, 1952) and *The Blue Mountain Express* 20, no.4 (Fall 1991), the quarterly magazine of the Western Maryland Railway Historical Society, provided by Mark Topper of Glyndon, Maryland, who brought the photograph of the *Belle Halladay* to the attention of the author. The date and setting of the photograph are unknown.



The tern *Emma L. Cottingham,* shown here in an anonymous oil painting. Photo courtesy of the Atlantic County Historical Society, Somers Point, New Jersey.

The *New York Maritime Register* of 21 December 1910 reported the loss of the *Halladay* on 13 December near Pollock Rip Light. She missed stays while getting under way, drifted into the anchored four-masted schooner *General E. S. Greeley,* and was holed on the *Greeley*'s anchor. The *Halladay*'s crew was saved; the *Greeley* lost her head rig.[31]

AN EXAMPLE OF RECONSTRUCTION: *EMMA L. COTTINGHAM*

The availability of an anonymous painting of the *Emma L. Cottingham* (above), a model alleged to be that from which she was built, and her tonnage measurements presented an array of information that indicated an easy reconstruction. Unfortunately, this was not the case.

A preliminary study showed conflicts among the three sources, which figure 13 on page 138 seeks to resolve. It would have been possible to develop figure 13 directly from the painting, model, and tonnage admeasurement, but in order to illustrate the complete process of reconstruction, the model lines and a tonnage plan (see figures 11 and 12 on page 137) were drawn separately. The superimposition of transparencies of these drawings would show the evolution of the design reconstruction.

The tonnage plan was drawn from dimensions entered in the tonnage admeasurement form. Study of the rules of the American Shipmasters' Association and American Lloyd's Standard Survey indicated a depth of about seventeen inches from the inside of the ceiling to the molded line of the keel, and this dimension was used to establish a base line corresponding to the keel rabbet, or bottom, of the model. Waterlines corresponding to those of the model were then drawn on the tonnage plan.

A drawing (not illustrated here) was then made on transparent paper, representing the body, sheer, and half-breadth plans expanded from the tonnage sections to represent the outside of the frames, and thus corresponding to the model. Only the four-, eight-, and twelve-foot buttocks and the four-, eight-, and twelve-foot waterlines were necessary to achieve the desired accuracy. This drawing was then superimposed on the lines derived from

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[31] *New York Maritime Register,* 21 December 1910.

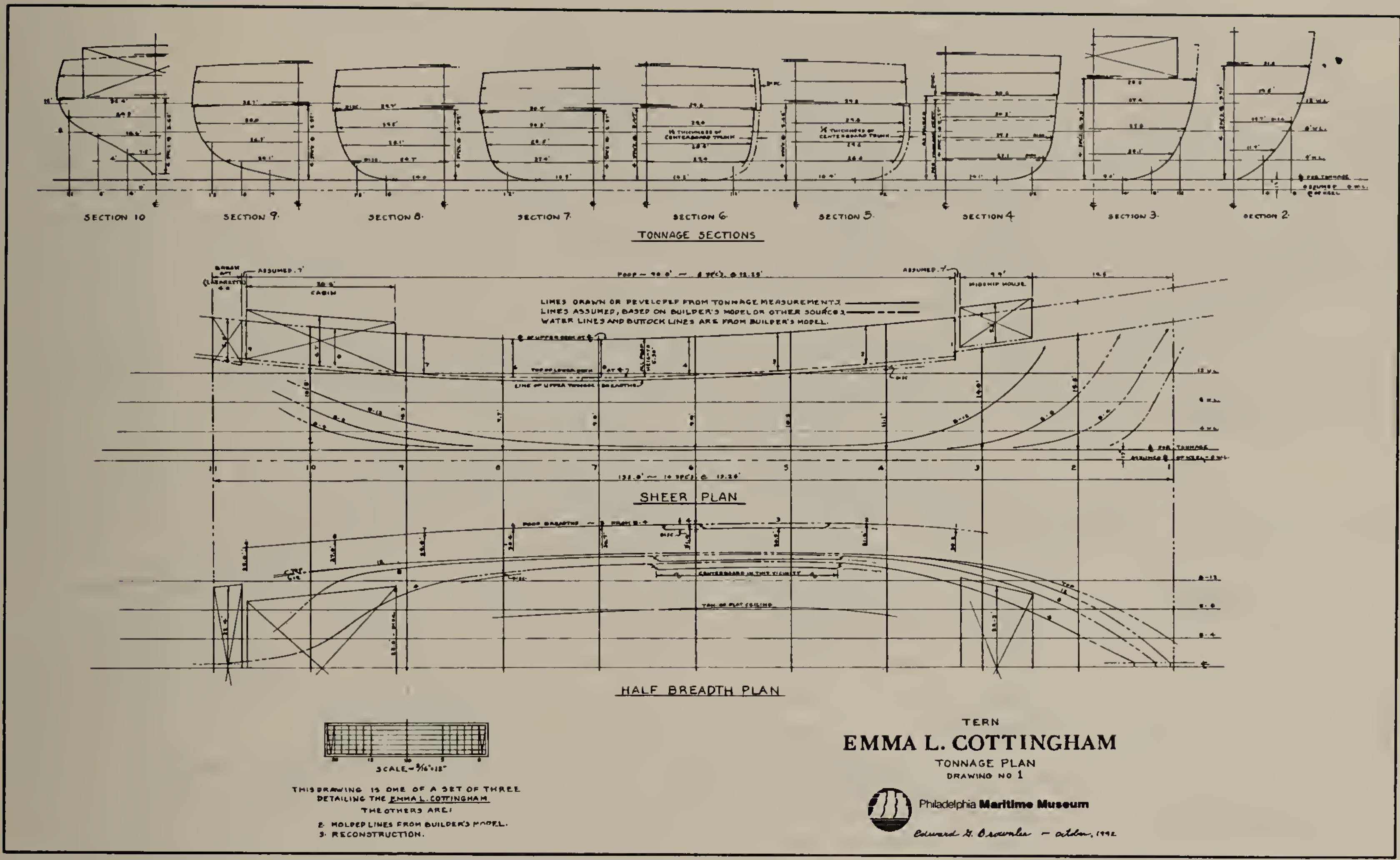
SECTION 10
SECTION 9
SECTION 8
SECTION 7
SECTION 6
SECTION 5
SECTION 4
SECTION 3
SECTION 2
TONNAGE SECTIONS
CABIN
ASSUMED
MIDSHIP HOUSE
LINES DRAWN OR DEVELOPED FROM TONNAGE MEASUREMENTS
LINES ASSUMED, BASED ON BUILDER'S MODEL OR OTHER SOURCES
WATER LINES AND BUTTOCK LINES ARE FROM BUILDER'S MODEL.
TOP OF LOWER DECK
LINE OF UPPER TONNAGE DECK
SHEER PLAN
TOP OF FLAT CEILING
HALF BREADTH PLAN
SCALE – 3/16" = 1'
THIS DRAWING IS ONE OF A SET OF THREE
DETAILING THE EMMA L. COTTINGHAM
THE OTHERS ARE:
2. MOLDED LINES FROM BUILDER'S MODEL.
3. RECONSTRUCTION.
TERN
EMMA L. COTTINGHAM
TONNAGE PLAN
DRAWING NO 1
Philadelphia Maritime Museum
Edward G. Brownlee – October, 1992

Figure 11: Tonnage plan of the tern *Emma L. Cottingham,* based on the Great Egg Harbor tonnage admeasurement certificate dated 2 December 1875.

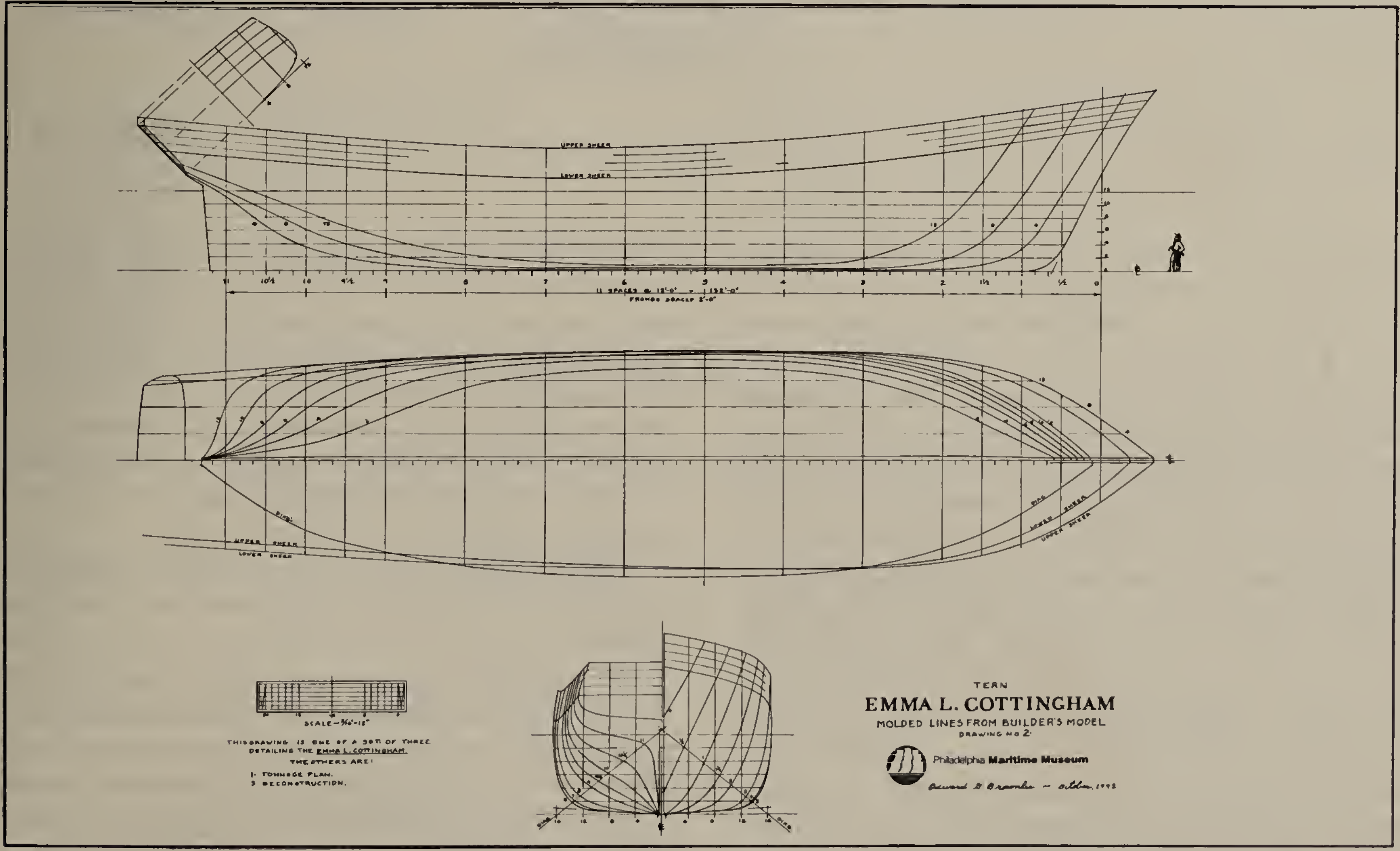
UPPER SHEER
LOWER SHEER
11 SPACES @ 12'-0" = 132'-0"
FRAMES SPACED 2'-0"
UPPER SHEER
LOWER SHEER
DIAG.
SCALE – 3/16" = 1'
THIS DRAWING IS ONE OF A SET OF THREE
DETAILING THE EMMA L. COTTINGHAM.
THE OTHERS ARE:
1. TONNAGE PLAN.
3. RECONSTRUCTION.
TERN
EMMA L. COTTINGHAM
MOLDED LINES FROM BUILDER'S MODEL
DRAWING NO 2.
Philadelphia Maritime Museum
Edward G. Brownlee – October, 1992

Figure 12: Molded lines derived from the builder's model of the tern *Emma L. Cottingham* in the collection of the Atlantic County Historical Society, Somers Point, New Jersey.

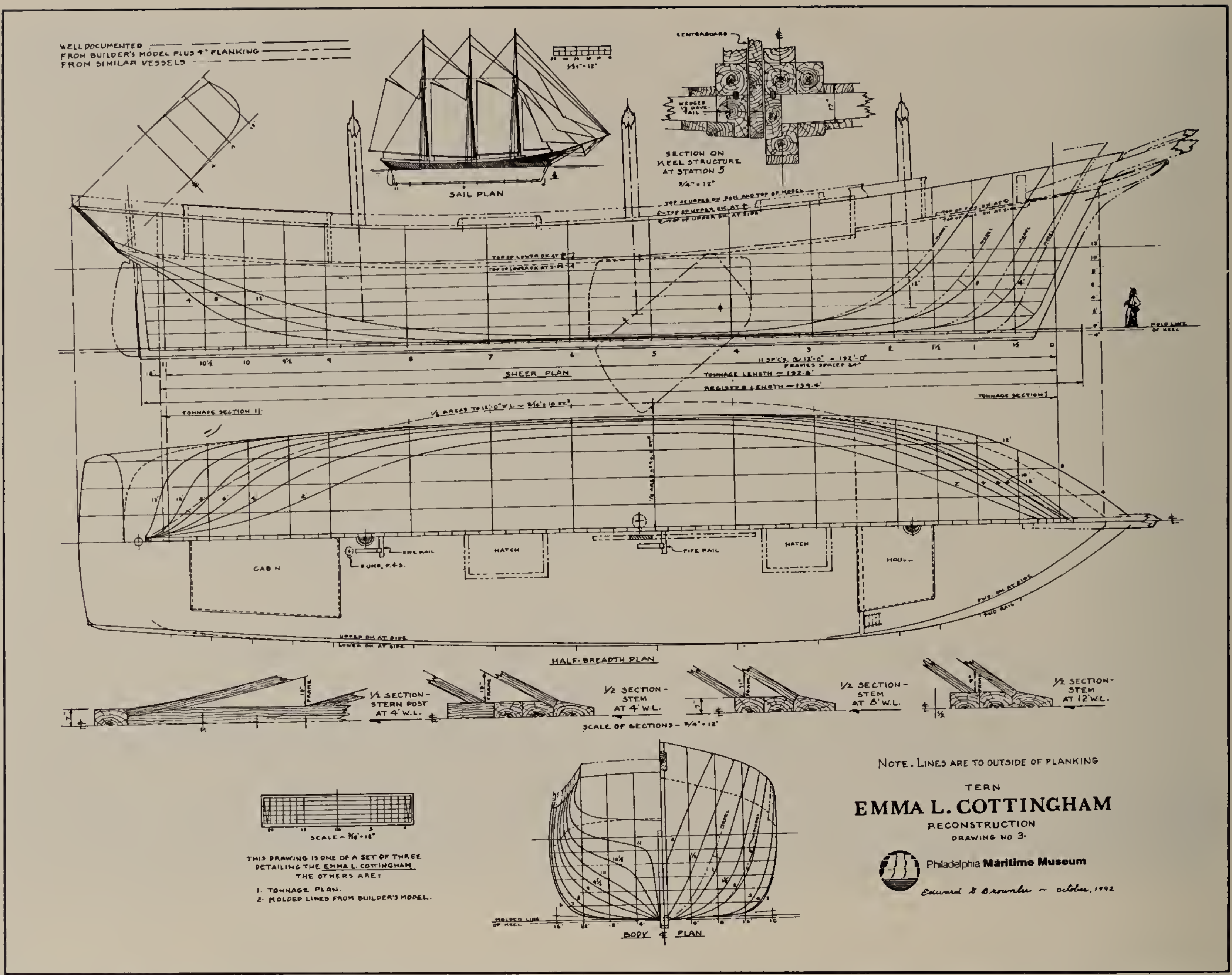
WELL DOCUMENTED
FROM BUILDER'S MODEL PLUS 4" PLANKING
FROM SIMILAR VESSELS
SAIL PLAN
CENTERBOARD
WEDGED ½ DOVETAIL
SECTION ON KEEL STRUCTURE AT STATION 5
¾" = 12"
TOP OF UPPER DK RAIL AND TOP OF MODEL
TOP OF UPPER DK AT ℄
TOP OF UPPER DK AT SIDE
TOP OF LOWER DK AT ℄
TOP OF LOWER DK AT SIDE
MOLD LINE OF KEEL
SHEER PLAN
11 SP'C'S. @ 12'-0" = 132'-0"
FRAMES SPACED 24"
TONNAGE LENGTH — 132.8'
REGISTER LENGTH — 139.4'
TONNAGE SECTION 1
TONNAGE SECTION 11
CABIN
HATCH
PIPE RAIL
HOUSE
HALF-BREADTH PLAN
½ SECTION - STERN POST AT 4' W.L.
½ SECTION - STEM AT 4' W.L.
½ SECTION - STEM AT 8' W.L.
½ SECTION - STEM AT 12' W.L.
SCALE OF SECTIONS - ¾" = 12"
SCALE — 3/16" = 12"
THIS DRAWING IS ONE OF A SET OF THREE DETAILING THE EMMA L. COTTINGHAM THE OTHERS ARE:
1. TONNAGE PLAN.
2. MOLDED LINES FROM BUILDER'S MODEL.
BODY PLAN
NOTE. LINES ARE TO OUTSIDE OF PLANKING
TERN
EMMA L. COTTINGHAM
RECONSTRUCTION
DRAWING NO 3
Philadelphia Maritime Museum
Edward S Brownlee ~ october, 1992

Figure 13: Reconstruction of the tern *Emma L. Cottingham,* based on the photograph and figures 11 and 12 on page 137.

the model. A very close fit was found aft, and the underwater after body of the model was then assumed to be correct. This fit also established the aft end of the tonnage length. The forward lines of the overlay and the model lines did not coincide, and it was decided that the tonnage measurements should prevail. Perhaps the builder was dissatisfied with the bow and moved the stem about three feet farther forward, refairing the forward thirty-six feet in an unknown manner, possibly using battens or ribbands to obtain the shape of the customary forward canted frames.

The reconstruction proceeded on this basis, and the next step was to locate the decks. The portrait of the *Cottingham* depicts a single-deck hull with a short poop. The tonnage admeasurement shows a very long poop, making her a virtual double-decker, a configuration very popular in southern New Jersey. With such an arrangement, the upper deck rail was customarily only about two feet high, including the covering board, and was closed in. The top of such a rail was found to be parallel to the sheer of the model and about the same height above the keel rabbet. Tonnage heights at sections two and three show that the forward deck was higher than the lower deck, aft of it, a not unusual arrangement. The four-foot-long lazarette is assumed to be aft of the cabin, with its aft side terminating at the aft tonnage section. It would more commonly have extended to the transom. The painting of the vessel on page 136 shows no evidence of a raised forecastle deck, but this may be an error.

The houses were positioned in logical locations, which also agreed with the portrait. The masts were then placed, followed by the centerboard. The latter was located from evidence on the tonnage plan and studies undertaken while reconstructing the plans of the *Belle Halladay.* The unusually great breadth of the house was assumed to have been measured at its mid-length. The breadth of the cabin (strangely the same as that of the house) was assumed to have been recorded at its forward end, since parallel sides would have resulted in a very restricted passageway on deck at its aft end. It is interesting to note that the headroom in the house, occupied by crew and galley, was only 5.5 feet, compared to 6.7 feet in the cabin. Such differences were not uncommon on contemporary vessels. The tonnage plan was accepted as giving the most accurate representation of the deck and rail configuration, and it is therefore believed that the painting was completed before the *Cottingham* was launched.

The sail plan was developed from the portrait and from data on similar schooners, except for the manner of securing the forestay. The painting shows the forestay attached to the bowsprit just ahead of the stem. This practice was common on early schooners with short forward decks, but the *Cottingham*'s long forward deck suggests the likelihood that her forestay was secured aft of the stem in accordance with later practice, and where a stronger attachment could be made.

The lines of the reconstruction have been drawn outside the planking in order to represent the actual vessel more completely. Her area curve produces a block coefficient to the twelve-foot design waterline of .66 and a center of buoyancy close to midship. Both of these findings are very typical.

The *Cottingham*'s particulars, from the *American Shipmaster's Association Record, American Lloyd's Register,* and Great Egg Harbor tonnage admeasurement certificate dated 2 December 1875 are as follows:

Built	December 1875 at Somers Point, NJ, by Israel Smith in the yard of Job Van Sant. Abandoned June 1906.[32]
Official number	135,177
Signal Letters	JKMQ
Length, register	139.8'
Tonnage length	132.8'
Breadth, register	34.0'
Depth, register	15.9'
Gross tons	522; Net 496
Construction	Double Deck; Centerboard [not recorded in 1891; probably removed]; white oak, yellow pine, galvanized iron fastened
Hailing Port	Somers Point, New Jersey (entire life)
Masters	J.B. Steelman; Jas. E. Somers; English; A. Phinney
Managing Owners	J.B. Steelman & others, Bartlett & Sheppard; J.B. Steelman; W.H. Skinner; A. Phinney

CONCLUSIONS

The foregoing describes the results of the author's research and his experience in using tonnage admeasurements to aid in reconstructing the designs of wooden sailing vessels built without formal plans. Particular pains have been taken to illustrate the process of coordinating the tonnage measurements with the lines drawn from models of specific vessels. Experience has shown that, with practice, it is possible to shorten the process by drafting only those lines that are most illustrative of conflicting data, such as the sheer, the buttocks aft, and waterline forward.

The author's process has wider applications. It could also be used for a steel or iron sailing vessel, if proper consideration is given to the thickness of framing and the ceiling. Reconstruction of early self-propelled vessels may be hampered, however, by the measurer's treatment of the space occupied by propelling machinery, which was sometimes defined by the reduction of the surrounding dimensions to represent the measurer's interpretation of the machinery and the necessary working space around it. Alfred C. Weber, a marine consultant and professional admeasurer, has successfully reconstructed several small modern steel self-propelled vessels for legal purposes when plans were unavailable.[33]

In the reconstruction of any vessel built without well-detailed and authenticated plans, the tonnage admeasurement provides information that cannot be ignored. It provides an effective as-built plan, more accurate than any other documented representation of the ship.

◆

Edward G. Brownlee learned to sail in Philadelphia harbor and first went to sea in coasting schooners in 1932. His experiences led to a lifelong interest, in his words, "in ships and what made them tick." He studied naval architecture in night school while working as a shipyard draftsman, and he put his skills to work building tankers and oilers for the RTC Shipbuilding Corporation during World War II. He served as vice president of that company from 1945 until its liquidation in 1959, after which he continued to work in the field of marine sales and operations. He is now semi-retired and devotes much of his time to researching and preserving the history of the shipbuilders of South Jersey and the wooden ships built by them. Brownlee also serves as a member of the Editorial Advisory Board of The American Neptune.

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[32] Sarah W. R. Ewing, "The Van Sant Family Shipyards," *The Atlantic County Historical Society Year Book, 1976-1977,* 66-76; R. Craig Koedel, "Shipbuilding: An Early Shore Industry," pre-publication offprint of a chapter of Koedel's projected *Ships and the Sea Down Jersey* (privately printed, 1986); Fred Erhardt, *Sailing Ships, Baymen's Work Boats, Shipbuilding, and the Tools of the Baymen in Atlantic County, New Jersey* (Somers Point, NJ: Atlantic County Historical Society, 1990).

[33] Alfred C. Weber, of New Orleans, a public admeasurer and consultant and contractor to the American Bureau of Shipping.

Appendix
General Directions for Taking the Measurements of Vessels

(from I. R. Butts, *Merchant's and Shipmaster's Manual and Shipbuilder's and Sailmaker's Assistant,* vol. 1, *Manual of Admeasurement* [Boston: I. R. Butts and Co., 1875], 37-38; see also figure 2 on page 123)

"The *correctly* taking of the required measurements being of considerable importance, the following general directions to that end may be useful for the guidance of those who have not a professional acquaintance with the subject: —

"Length. — The length at the tonnage-deck is to be taken by tightly stretching a line on the upper surface of the deck, at such a parallel distance from the middle line of the ship as to clear the several hatchways and other obstacles that may present themselves; the line is then to be measured, marking the ends of the line on the deck; these points are then to be squared in to the middle line of the ship, and the distances taken from them so squared in, to the inside of the plank at the bow and stern, deducting from this length what is due to the rake of the thickness of the deck, and also what is due to the rake of the stern-timber in one-third of the round of the beam;[1] the sum of these two distances added to the length of the line measured, as aforesaid, gives the whole length required.

"Points of Division of the Length, or Stations of the Transverse Areas. — The length, taken as above described, being divided into the required number of equal parts, the points of division, which are the stations of the areas, are to be marked correctly on the tonnage-deck: a line is then to be extended down the main hatchway, at the middle line of the ship, in a direction perpendicular to the keel, by means of a square placed on the upper side of the keelson; the distance of the midship area from this line at the tonnage-deck is then to be set off from this line on the keelson, which gives the station of the midship area on the keelson; and the stations of the others are obtained on the keelson by setting off afore and abaft the midship one, the common interval between them, as already marked off on the tonnage-deck.

"Depths. — The depth at the midship area is to be taken in a direction perpendicular to the keel from the under side of the deck to the upper side of the floor timber at the inside of the limberstrake, keeping the measuring staff square to the keel by means of a square placed on the upper side of the keelson, deducting from this the depth one-third of the round of the beam[2] and the average thickness of the ceiling on the floor-timber. The depths at the other areas are to be taken in the same way, placing the measuring staff square to the line in continuation of the upper side of the keelson in midships.

"Breadths. — The depth at any area being taken as above directed, and divided into the required number of equal parts, the breadths are to be taken at the points of division, and also at the upper and lower points of the depth as follows: —

"A stiff batten or staff, with the points of division or stations of the breadths properly marked on it, is to be fixed in position (perpendicularly both ways) to the side of the keelson; the breadths of the vessel are then to be taken by stretching a line, square athwartships as well as horizontally, through each point marked on the batten, as aforesaid, from ceiling to ceiling (taking the average thickness between the respective points of measurement); but to insure the athwartship and horizontal direction in which the line is to be held, two other battens may be placed in the same athwartship plane with the one already in position, one on either side of it, at equal distances from the middle line of the keelson, having the heights at which the breadths are to be taken levelled out on them; the line then held through the respective points on each batten, insures the proper direction in which the breadths are to be taken."

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[1] This is to give the length at the medium height of deck.

[2] This point at each area is termed the medium height of deck there; for the area under the level of this height will be found to measure, very nearly, the same as the actual area bounded by the round or curve of the beam; which will be immediately perceived by describing the round of the beam, and drawing a horizontal line across it at one-third of the round set down from its middle point.

It may be observed, that the breadth of the beams, at the different areas, do not vary enough to cause any appreciable difference in the one-third of their rounds, therefore one-third of the round of the midship-beam may, with practical correctness, be set down at every area, except at the extreme ends of the length.

News

Ship Preservation Conference

The Naval Historical Center Detachment Boston, responsible for the maintenance and repair of the USS *Constitution,* will host a conference on "Technical Aspects of Maintaining, Repairing, and Preserving Historically Significant Ships" at the Charlestown Navy Yard on 12-14 September 1994. The conference will be participatory in nature, with panel discussions, circulation of presented papers, and the formation of committees to investigate special subjects of interest. The National Maritime Alliance will host its annual meeting at the same location, directly following the technical conference. For further information, contact Patrick Otton, Naval Historical Center Detachment Boston, USS *Constitution* Maintenance and Repair Facility, Bldg. #24 B.N.H.P., Charlestown Navy Yard, Charlestown, MA 02129-4543.

International Congress for Maritime History

The Dutch Association for Maritime History, in cooperation with the Netherlands Maritime Museum and the Maritime Museum Prins Hendrik, will hold the second International Congress for Maritime History in Amsterdam and Rotterdam from 5 - 8 June 1996. The conference theme is "Evolution and Revolution in the Maritime World in the Nineteenth and Twentieth Centuries." Proposed paper topics should fit into one of the following categories: nautical science and cartography; the construction, equipment, and propulsion of ships; the management and infrastructure of navies; shipping companies; and ports. For information, contact Mrs. drs. C. Reinders Folmer, P. O. Box 102, 2350 AC Leiderdorp, The Netherlands.

A (Not So) Serious Look at High Seas Humor

The social world of the mariner, curious habits and customs, and landlubbers' perceptions of sailors on shore leave are all part of an exhibit entitled "Salty Dogs: High Seas Humor Then and Now," which opened on 17 June 1994 at the Peabody Essex Museum. The exhibit contains eighteenth- and nineteenth-century caricatures by Cruikshank and Hogarth, scrimshaw depicting humorous scenes, a bawdy illustrated journal, and other items that highlight idiosyncracies of the seafaring life. Modern political cartoons that employ maritime imagery and a comic strip that pokes fun at maritime museums add a modern dimension to the exhibit. The show offers serious and humorous insights into maritime societies and the unique social relations that govern them.

Folk Art Reflects Maritime Heritage

The current exhibit at the Peabody Essex Museum, "In the American Spirit: Folk Art from the Collections," highlights the influence of the maritime industries on the artistic traditions of eighteenth- and nineteenth-century New Englanders. Although the show contains over one hundred pieces produced by artists outside of the trained fine art tradition, objects such as ship carvings, portraits of merchant captains, ship models, and painted seascapes appear throughout as reminders of the integral relationships between daily life, work, and the production of decorative objects in early New England seaport communities. One such example, the oil painting *Launching of the ship* Fame, by George Ropes, appears on the cover of this issue. The exhibit runs through September 1994.

James Buttersworth on View

More than fifty paintings by one of the most renowned nineteenth-century maritime artists have been assembled for the exhibition "Ship, Sea and Sky: The Maritime Art of James Edward Buttersworth." The show is currently at the South Street Seaport Museum in New York through August. In September it will open at the Peabody Essex Museum and in January 1995 it will move to the Terra Museum of American Art in Chicago. A 128-page fully illustrated color catalog by exhibitions curator Richard Grassby accompanies the exhibition.

Subscriber John R. Stilgoe wishes to trade his set of *The American Neptune* for a fourteen- or sixteen-foot round-bottom (carvel or lapstrake) wooden rowboat in restorable condition. Stilgoe's set of the *Neptune* is complete from vol. 1, no. 1 (January 1941) through vol. 42, no. 4 (October 1983). It includes most subsequent issues but is missing vol. 44, no. 1 (Winter 1984); vol. 47, nos. 1 and 4 (Winter and Fall 1987); vol. 48, all four issues; and vol. 49, no. 4 (Fall 1989). Interested readers can contact Stilgoe at 161 Central Street, Norwell, MA, 02061, (617) 659-2090.

In William Thiesen's article "The Curse of the *Dolphin,"* which appeared in the Winter 1994 issue of *The American Neptune,* a caption under the photograph on page 31 was inadvertently omitted. The photograph depicts Secretary of the Navy William C. Whitney. The *Neptune* regrets the omission.

Book Reviews

BARRY GOUGH, *The Falkland Islands/Malvinas. The Contest for Empire in the South Atlantic* (London: The Athlone Press, 1992). 212 pages. $65.00. ISBN 0-485114-19-4.

In this volume, Professor Barry Gough has produced a most interesting study of the struggle for control of the Falklands/Malvinas, an issue that has deep roots in the past and potential importance for the future. The work is a good companion volume to Hoffmann and Hoffmann's *Sovereignty in Dispute: The Falklands/Malvinas, 1493-1982* (Boulder, CO: Westview Press, 1984).

Gough's book shows us the different phases of this long and complex drama: the contesting claims of discovery; the competition between Britain, France, and Spain in the eighteenth century; the British withdrawal in 1774 and the Spanish settlement; Argentine claims and presence after independence; the American intervention in 1831 and the British decision to reoccupy the Falklands; and the continued diplomatic struggle since 1833 which ended in the tragic war of 1982.

Leaving aside the diverging claims of discovery, the real contest started in the eighteenth century. It involved Spain, trying to keep foreigners away from her empire in the South Atlantic; France, looking for new horizons after the loss of Canada; and Great Britain, needing "a convenient station . . . near Cape Horn" (p. 10). First came the French, who settled in 1764 in Port Louis, East Falkland/Isla Soledad. Then the British came to Port Egmont, West Falkland/Gran Malvina in 1765-66. The Spaniards complained about the French intrusion, after which the French agreed to depart and were replaced by the Spaniards in Port Louis — then renamed Puerto Soledad. The Spaniards expelled the British by force from Port Egmont in 1770, but British pressure led to the restitution of Port Egmont in 1771. There were references to a secret agreement — never found in writing — suggesting that the Spanish restitution was only symbolic and that the British would leave shortly after their repossession. In fact, either because of the agreement or because of other priorities, the British departed Port Egmont in 1774, leaving a lead plate claiming their rights. Therefore, from 1774 on, the Spaniards were the only permanent settlers in the islands. Pressed by insurrection in South America, the Spaniards left Puerto Soledad in 1811.

In 1820, Navy Colonel David Jewitt, an American serving the government of Buenos Aires, arrived in the islands in command of frigate *Heroina*, hoisted the Argentine flag, and took possession of the archipelago in the name of the United Provinces — the name given to Argentina in those days.

On 2 February 1825, the British and Argentine governments signed a treaty of amity and commerce. In Gough's words: "This was the first treaty made by any of the new States of the Americas, and the first *de jure* recognition of their national existence by any European power" (p. 47). On 10 June 1829, the government of Buenos Aires created the office of "Political and Military Commander" of the islands and appointed Luis Vernet to this post. At the time, Vernet had resided in Puerto Soledad for several years.

Besides depicting what was happening in the southwest Atlantic, Gough deals comprehensively with the events in London, showing the British government's reluctance to reoccupy the islands — the final decision against it being taken by the Duke of Wellington, then prime minister. The Argentine actions of 1829, however, ended British reluctance. "The Argentine decrees of 10 June 1829 brought forth two interventions: one American, one British. Of these, the first was swift and savage, the second was slow and overwhelming. The first reflected the United States' determination to have freedom of the seas for her fishermen, the second demonstrated Britain's will to secure a base valued by rivals. Argentina was on the receiving end of both these interventions, and reeled from the one only to be flattened by the other. Not that the United States and Great Britain planned this double blow. However, to bewildered Argentine ministers and diplomats it all must have seemed like a slick bit of collusion."

Captain Robert Fitz-Roy, RN, described the first intervention in his *Narrative of the Surveying Voyages of His Majesty's Ships* Adventure *and* Beagle (London, 1839): "In 1829 Vernet warned off some North American sealers; and in 1831, upon their repeating the sealing excursion of which he had complained, he detained them by force. This act, and various circumstances arising out of it, drew upon him and his unfortunate colony the hasty indignation of Captain Silas Duncan, of the United States corvette *Lexington*, who, on his own responsibility, without waiting to communicate with his government, sailed from La Plata to the Falkland Islands, surprised, assaulted and made prisoners of many unoffending people, and unwarrantably destroyed both property and buildings." The U.S. government fully supported Captain Duncan's actions, and these incidents — Vernet vs. the sealers, and the USS *Lexington* intervention — seriously embittered U.S.-Argentine relations for many years.

The Buenos Aires government set in motion the restoration of its settlement in Puerto Soledad, but this short-lived attempt foundered on 3 January 1833 when Captain Onslow, in command of HMS *Clio,* put an end to Argentine rule over the Falklands/Malvinas. Following this event, the British only reluctantly settled in the islands, appointing a resident in January 1834 and a lieutenant governor in 1842. From 1833 onward, Argentina complained to the British government about the forceful occupation of the Falklands/Malvinas, and the British consistently rejected their complaints. The same pattern continued for many years: regular Argentine protests and regular British rejections.

From the late nineteenth century to the early 1940s there was a significant degree of economic cooperation between Britain and Argentina, and political relations were smooth. However, the Falklands/Malvinas issue remained as "the only cloud on the friendship between the English and the Argentine peoples," as the distinguished Argentine naval officer Segudo R. Storni put it in *Intereses argentinos en la mar* in 1916, when Britain was *the* superpower.

The issue remained unresolved, and in 1965 the UN General Assembly approved a resolution inviting Britain and Argentina to hold discussions to settle their differences. Initially negotiations went well, and it appeared that substantial progress had been made. However, relations between Britain and Argentina became strained over this issue in the mid-1970s. In 1980 talks were resumed in a better atmosphere, but unfortunately the dispute remained unresolved and further tensions led to the March 1982 crisis and subsequent war. Relations between the antagonists remained poor, with Argentina presenting the case annually at the UN General Assembly and Britain ignoring the successive resolutions.

In 1989 a newly elected government took office in Argentina which sought to reach some degree of detente with Britain. The period since late 1989 has seen significant improvements: the two sides agreed to a formula whereby talks continued without affecting each party's claims, consular relations were resumed and later diplomatic relations were reestablished, and confidence-building measures were devised for the southwest Atlantic as well as resource preservation arrangements for the area.

I have only one major disagreement with Professor Gough's well-researched and balanced analysis: He states on page 153 that ". . . Argentina invaded South Georgia in March and the Islands on 2 April. . . ." However, there are several distinguished English-speaking authors, such as David Brown (*The Royal Navy and the Falklands War*, 1987), Lord Franks (*Falklands Islands Review*, 1983), and Admiral Harry Train ("An Analysis of the Falkland/-Malvinas Islands Campaign," *Naval War College Review* 321 [Winter 1988]), who do not consider the landing of Argentine scrap workers in South Georgia on 19 March 1982 an "invasion."

In spite of the aforementioned major improvements in British-Argentine relations, which suggest an enduring "peaceful coexistence," this reviewer invites the careful reading of the book's last sentences: "To this date, the Falklands remain one of the unravelled puzzles of human history. Equally it remains one of the unresolved problems of international affairs which merits every attention by politicians and statesmen intent on the peaceful resolution of conflict and the avoidance of war" (p. 159).

In summary, Barry Gough has written a highly commendable book for all those interested in this complex issue in international relations.

CAPTAIN G. J. MONTENEGRO

Buenos Aires, Argentina

ROBERT W. LOVE, JR., *A History of the U.S. Navy, 1795-1991,* 2 vols. (Harrisburg, PA: Stackpole Books, 1992). ISBN 0-811718-62-X. $39.95.

This large, two-volume work on a navy, now incomparably "second to none," will interest historians, sailors, and perhaps some power brokers concerned with naval policy. It may even adorn the bookshelves of some budding naval officer at Annapolis. There are benefits to be had from the clear-eyed, no-nonsense, pragmatic approach of Robert W. Love, Jr., and the most important is that jellied patriotism and dollops of hero worship are, generally, conspicuous by their absence.

In this history, the always uneasy relationship between a burgeoning trading state and the development of a more sophisticated view of growing national power are highlighted, but not as response to some everlasting rules of naval growth. Furthermore, the author refuses to allow the shaping of the relationship between sea activity and state policy to be determined by pre-set guidelines of "sea power." It has always seemed to outsiders, Paul Kennedy excepted, that Mahan was given too much credit as a naval stimulus and protagonist by the American nautical establishment. Many observers thought of him as a mere historian who looked at his own navy shrewdly, but through a spyglass calibrated in terms of the Royal Navy. In this book the baby goes out with the bath water, and we are given a Mahan who was merely "an actor in the late nineteenth-century drama" rather than either a historian or theorist. Other historians are dismissed as cavalierly. Kenneth Hagan's *This People's Navy* is shrugged off with the words "a New Left interpretation of American foreign policy." Love is much kinder to his other colleague Paolo Coletta, but he can be acid about documentation.

It must be said at once that, freed from the trammels of conventional strategic piety, light does flow through this new glass. The author shows, quite rightly, that in the Revolutionary period small ship actions paled into insignificance before the larger diplomatic needs seen by George Washington, that peerless leader. Moving easily down from strategy to tactics, Love has been able to state that the victory at the Battle of the Virginia Capes was due to "superior command and control and a conservative battle doctrine" and not to "firepower or innovation." A firm judgment.

As Britain entered the long Napoleonic ordeal, the new United States was faced with the need to secure a survival policy for its trade. This uneasy search culminated in a war with Britain in 1812. In the meantime, the British had debated the possibility of allowing America free trade in the Caribbean. This important controversy, crucial to America, is unremarked in Love, as are the motives and activities of most other naval states. The Americans were concerned to sweep the fringes of a momentous conflict, involving huge and disparate interests, for profit alone. They needed either a huge building program to secure the maximum benefit of the role into which they were cast by fortune, or a highly developed peripheral strategy. Either was hard to develop. This book points graphically to the divisive effects of the stance that the Americans chose to adopt. Certainly it was the antithesis of George Washington's warning against adventurous diplomacy. Love's judgments on the American Civil War are refreshing, shrewd, and entertaining, by turns. The long cruise of the *Alabama* is noted, but it is also noted that the depredations of her long voyages had little real effect on the war, just as the great blockade at the center of command and attrition planning failed to interrupt significantly southern movement of important goods. McClellan is in and Grant is out as the Mississippi Campaign is presented as something more than a proving ground for Ulysses S. Grant. After Vicksburg, the Mississippi did not exactly flow "unvexed" to the sea, but it was true that Rebel sternposts did not cross those waters as frequently as they had done before.

The rise of American sea power in the worldwide sense makes it difficult for Love to continue his fastidious disdain for theory. Mahanian theories penetrated to the innermost places of American decision making through President Theodore Roosevelt, Admirals Sims and Benson, and then through a subsequent Roosevelt in World War II. Those are facts. It is also a fact that other impelling forces worked, even if unsuccessfully, in a contrary direction. It must be remembered that America is the America of Bob LaFollette as well as of George Marshall. Not only naval ratings come from the corn fields of the Midwest! It is a more extraordinary thing that the American navy was never as overtly tied to the dynamism of the Gospel according to Adam Smith as the Admiralty was in England. When all this was tested in the Second World War, the most important lesson learned by Love is that America could produce ships faster than anyone else could sink them. Winston Churchill understood this as early as 1926-27. And it was this fact, along with the persistence of the marvelous submarine force of the United States, that belled the Japanese cat. However, in turning to the short description of the Battle of the Atlantic, one is hard-put to recognize a coalition war. Indeed one is hard put to realize the common menace that Germany posed for the North Atlantic naval and military powers. As Peter Stanford stated in a recent issue of *Sea History,* on this war depended the whole of the western response to Hitler: It was a mortal struggle, to which Admiral King contributed grudgingly and late.

It is strange that a work concentrating on a modern era (one volume is completely post-1942) should be more valuable when it is read backward, like a Chinese tome. I commend the first volume for its diverting and challenging views and leave the second volume for the midshipmen to struggle through during long cold winter nights on the banks of the River Severn.

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H. T. WALLINGA, *Ships and Sea-Power before the Great Persian War: The Ancestry of the Ancient Trireme* (Leiden: E. J. Brill, 1993). xv + 217 pages, illustrations, bibliography. ISBN 9-004096-50-7. $80.00.

The period of approximately two and one-half centuries (ca. 735-480 B.C.) covered in this volume was an important one in ancient maritime history. Unfortunately, sources for the period are not abundant, and such evidence as we do possess is rarely, if ever, conclusive. It is Professor Wallinga's contention that this evidence has been universally misinterpreted. Consequently, he discards the conventional picture, which posits warships and ramming tactics at an early date and explains successive changes in ship type and size as a direct result of the requirements of naval warfare leading to the invention of the trireme by Greeks or Phoenicians early in the sixth century. Much of this misinterpretation of the evidence derives from a tendency to view it in a narrow context, divorced from military, political, and especially economic factors. Once it is recognized that the cost of building and maintaining a fleet of triremes was beyond the means of most cities, Greek or Phoenician, our focus must be directed to the kingdoms of the ancient Near East, for only they were capable of bearing such an expensive burden.

Throughout this period a two-fold, interrelated development took place. One facet of this development was the increasing use of state-owned ships, while the other involved technological improvement and increasing specialization in the ships themselves. For the first of these developments Thucydides is our only source, and Professor Wallinga accepts his view that there were three periods in the evolution of Greek seapower, each separated by a burst of tremendous change. In the first phase, prior to the late eighth century B.C., ships were privately owned and there were no specialized warships. In the second phase, lasting until the 480s, with Corinth leading the way, states began to acquire their own ships, and state ownership led to greater specialization until the invention of the trireme not long before the end of this phase. The final phase began with another spurt of activity after 486 B.C., resulting in the complete disappearance of privately owned ships and the acquisition of state-owned navies of triremes by the most important Greek *poleis.* The evidence for technological change is primarily iconographic, supplemented with some information from Homer, linguistics, archaeology, and occasional later literary references. From this evidence Wallinga concludes that by the late eighth century ships fell into two main categories, those with one bank of oarsmen and those with two banks. But there were no true sailing ships and little distinction between merchant galleys and warships. The primary ship for several centuries was the double-banked penteconter, which could function as a merchant galley but could also be equipped with a ram. It was only in the sixth century that sailing ships came into their own, specialized warships came into existence, and ramming tactics were developed.

Only in the sixth century, too, do we begin to get information about the nascent navies in the Greek world, and the author discusses the navies of the Phocaeans and of Polycrates of Samos in detail, always with an eye to causal connections. In each case, he argues, the navy was financed by transporting mercenaries for a foreign power. The rise of the Persian Empire provides the context for the appearance of two new ships, the *samina* capable of carrying both grain and troops and, more importantly, the trireme. The invention of the latter is described as a two-stage process that occurred between 540-525 B.C. The Carthaginians took the first step in response to the superior ramming tactics of the Phocaeans at the Battle of Alalia, which consisted of adding a third bank of oarsmen to the penteconter. The second step occurred in Egypt. In response to the Persian presence in Phoenicia and the Phoenician use of the new three-banked ships, the Egyptians increased the length of the penteconter by about half and added a third bank of oars, and the trireme was born. The trireme and Egypt's alliance with Polycrates was in turn viewed as a threat by the Persians, whose response was to build a navy of three hundred triremes, the ships provided by the king and manned by subject peoples.

With this new navy and the defeat of Egypt in 525 B.C., the Persians became masters of the sea. Although the fleet grew to six hundred triremes by 494 B.C., the Persians had no plans to conquer Greece; their policy, rather, was aimed at the elimination of any potential threat to their navy. Only Miltiades seems to have understood this; even Themistocles was in the dark. His proposal to build one hundred triremes for a war against Aegina took no account of the Persians, a serious miscalculation. Their reaction was to begin preparations for war, and when the invasion materialized three years later, the Persian navy consisted of 1,300 triremes, a figure Wallinga further defends in an appendix where he argues that they were undermanned and that such undermanning was normal in all ancient fleets.

This is an exciting, creative, and inventive work with something new on every page. The research is thorough, the major problems fully thought out, and the various arguments tightly knit and logically presented. There are more than four hundred footnotes conveniently located at the bottom of each page. The major problem is that much of the argumentation rests on scant evidence and, in some cases, as the author acknowledges, on no direct ancient evidence whatever. Wallinga is surely correct in emphasizing the enormous cost of building and maintaining a fleet and in stressing that most cities, whether Greek or Phoenician, lacked the economic resources to do so. While the effort to find a context and causal connection for everything is commendable, the nature of the evidence is such that certainty can rarely be claimed, and there are just too many houses of cards stacked here. The volume is, nonetheless, must reading for anyone interested in any aspect of ancient maritime history. By questioning and arguing forcefully against many long-held assumptions, Wallinga compels us to rethink many of our notions about ancient ships and navies. It remains to be seen how many of his arguments will stand the test of this rethinking.

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DAVID H. ROBERTS, ED. AND TRANS., *18th Century Ship-building: Remarks on the Navies of the English & the Dutch by Blaise Ollivier, 1737* (Rotherfield, England: Jean Boudriot Publications, 1992). Cloth, 384 pages, 120 drawings and illustrations, glossary, bibliography, appendices, index. ISBN 0-948864-11-7. £45.

Jean Boudriot Publications was initially created to make the works of its namesake, one of France's leading authorities on sailing ships, available to a wider audience. Readers should note that its founder, David H. Roberts, is a freelance consultant in international strategy and a gifted author and translator. He has taken his firm beyond its limited goal and has embarked upon the publication of facsimile reprints of important primary sources on sailing ships of the seventeenth and eighteenth centuries. Seen in this light, one can hardly be surprised by this latest release. Blaise Ollivier was one of France's leading shipwrights, who was entrusted in 1737 with a clandestine mission. He was to investigate the construction methods employed by his English and Dutch rivals, and his hitherto unpublished report sheds much light on this subject for all three of Europe's major seapowers of this period. Despite his rudimentary English and poor Dutch, he was able to gain access to many ships, draughts, and shipwrights during his mission. Roberts argues convincingly that Ollivier had been specifically charged to investigate the construction of three-deck ships-of-the-line.

This work is a composite of the two, slightly different, copies of Ollivier's manuscript known to exist. Roberts notes that a third copy, complete with letters to Maurapas, France's Minister of the Marine, has disappeared from the archives. One of these copies is now in Jean Boudriot's library while the other is held in the archives of the Brest dockyard. Roberts maintains that the Brest version is a revised copy and may have been intended for the education of Ollivier's son. Ironically, despite this report, France did not lay down a single first rate until 1757, twelve years after Ollivier's death. Nonetheless, Ollivier's marginal notes in the Brest manuscript clearly show that he made use of the knowledge gleaned from his undercover assignment.

The main text of this work is tightly organized along the basis of short notes on Ollivier's observations in the principle shipyards of England and Holland. During his mission he visited ten of their dockyards, only ignoring Plymouth in England and bypassing Hoorn and Enkhuijzen in Holland. He never amalgamated his observations on the English yards into a unified whole but rather recorded them one by one. Ollivier later prepared an index so that the construction methods employed in English yards could be more easily compared and contrasted. In the case of the Dutch yards, he describes them and then discusses their methods of construction in a more unified manner. This difference in presentation is probably explained by the fact that he spent two months in England and only six weeks in Holland. Furthermore, the Dutch were simply not building many first rates at the time of his visit.

Roberts has taken care to note the differences between the two copies of this work, and his comprehensive system of notes clearly highlights the differences between them. He has taken care to explain why he chose the various terms employed in this text. His overriding concern was to render this text comprehensible to modern readers with an interest in the art of building wooden sailing ships, so he has eschewed most, but not all, of the more archaic terminology of the period. He has also provided a translation of Ollivier's *Glossary of Ship-building Terms* which appeared in a work of 1736. Thus, this volume provides us with the most detailed picture currently available on the shipbuilding practices of Europe's major maritime powers in this period.

The wealth of information presented in this volume is staggering. Roberts notes at least twenty-one different observations made by Ollivier which seriously challenge our conception of the construction methods of the time. Ollivier's observations are remarkably free of bias; out of the 160 divergent methods that he comments upon, 100 of them met with his approval. Roberts does point out that Ollivier was generally more favorably impressed by the practices he witnessed in England than in Holland. One interesting facet of this work is Ollivier's surprise with the Royal Navy's euphemistic use of the term "rebuild." This practice was simply not necessary in Ollivier's more autocratic homeland.

Numerous contemporary illustrations, drawings made by Ollivier and Boudriot, and a few photographs of museum models complement this work. Most of the drawings are scaled, and they provide a unique perspective on the joints and parts of a ship. Ollivier also included a bibliography of English manuals on the shipwright's art, with a commentary on their relative merits. Also included are lists of the strength of the English and Dutch fleets in 1737. Strangely, Roberts notes that Ollivier had clearly overestimated the size of the Dutch fleet. One must wonder if the Dutch were more wary of this Frenchman and practised an early form of "disinformation." Roberts has also decided to transcribe the full French text of Ollivier's work and include it as an appendix.

Overall, this was as much a labor of love for Roberts as it was for Ollivier. Roberts is to be commended for making this extremely rare manuscript available to readers with a strong interest in shipbuilding in the 1700s. He has shown that even in a so-called period of stagnation, new ideas were being pursued in the yards of Europe's three major seapowers. This work is a more than welcome addition to our knowledge of ship construction in this era, and one can only hope that Roberts will continue to provide us with reference works of this quality in the future. It can be wholeheartedly recommended to ship enthusiasts and should appeal to model makers as well.

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ARNOLD BERWICK, *The Abraham Lincoln of the Sea: The Life of Andrew Furuseth* (Santa Cruz, CA: Odin Press, 1993). 176 pages. ISBN 0-963361-10-4. $19.95.

Andrew Furuseth was a Norwegian sailor who landed on the shores of San Francisco Bay in 1880 and went on to become an important figure in the American labor movement. He was an early member of the Sailors' Union of the Pacific (SUP), which he "rescued" from a group of Socialists and then built into one of the most powerful, and ruthlessly practical, trade union organizations on the West Coast. He also served as the president of the International Seamen's Union (ISU), an umbrella organization of seafaring affiliates that, ironically, never achieved either the power or the prestige of the SUP. The crowning moment in Furuseth's career came in 1915, when, after decades of effort on his part, the LaFollette's Seamen's Act became the law of the land and American seamen finally achieved the same legal status as other workers. According to his friends and admirers, including Senator Robert LaFollette of Wisconsin, after whom the law was named, it was Furuseth who was primarily responsible for freeing his fellow seamen from "bondage"; he thereby earned the titles "emancipator of the seamen" and "Abraham Lincoln of the sea." Although much of his career after the passage of the Seamen's Act was anticlimactic, even tragic, his reputation for honesty and integrity remained undiminished. When he died in January 1938, his body lay in state in the Department of Labor building in Washington, D.C., the first such honor ever accorded an American labor leader; later, his ashes were cast upon the waters of the Atlantic.

In 1959, the University of California Press published a biography of Furuseth by Hyman Weintraub, a professional scholar who had the benefit of a close association with some of the nation's most distinguished labor economists and historians as well as with a number of Furuseth's co-workers and friends in the SUP. *Andrew Furuseth: Emancipator of the Seamen* became not only the "definitive" biography of a legendary figure in maritime labor history but also one of the better biographies of an American labor leader for a generation.

Furuseth had already become a dim figure by the time Weintraub wrote his book. Since then, the seafaring unions that he labored a lifetime to build have become almost extinct. So why do we need yet another biography of the man whose stamp they bore? Arnold Berwick, the author of *The Abraham Lincoln of the Sea,* doesn't answer this question directly, but he makes it clear from the first page of his new biography that the entire undertaking was a labor of love. The inspiration for the book came from a fleeting encounter at a traumatic moment in the author's life when he was fourteen and his injured father lay in a hospital near death. His father told him that the room across the hall was occupied by "a good Norwegian" named Andrew Furuseth, and the boy went to have a brief look at the "old white-haired man who was propped up in bed and fast asleep." He quickly forgot about Furuseth but ultimately came to realize that he had been "privileged to stand in the presence of a great and noble spirit, . . . a leader unlike any we have today" (p. vii). His biography is intended to resurrect the memory of the man he so deeply admires. "I don't know what it means to have everlasting life," he concludes in the book's last sentence, "but I have written what you have read here with the hope that at least the memory of Andrew Furuseth will live on" (p. 158).

Whereas Weintraub's biography was aimed at a scholarly audience, Berwick's presumably is aimed at the general reader. Unfortunately, there is little reason to suppose that in a world saturated by books and, even more so, the products of electronic media, the career and personality of Andrew Furuseth will inspire much interest today. If there is a likely audience, it would almost certainly be labor historians, but this group will find Berwick's study unsatisfying. For one thing, we already have Weintraub's biography. He knew the larger terrain of American labor history well, whereas Berwick can claim no such expertise. Although Berwick presents a vivid, and largely accurate, portrayal of the lives of seamen under the old regime that preceded the SUP and the passage of the Seamen's Act, his characterizations of men and movements are sometimes oversimplified or wide of the mark.

Moreover, the discipline of labor history has changed dramatically since Weintraub wrote his biography in the late 1950s. Then, labor economists largely defined and dominated the field; they were concerned with the achievement of a stable and mutually beneficial relationship between labor and capital, and their focus was on leaders — power brokers and stabilizers — rather than on the faceless and potentially unruly rank and file. Furuseth was a fit subject for such scholars, precisely because he operated mainly at the top, in the legislative arena and the councils of the American Federation of Labor, and sought to improve and stabilize the relations between seamen and their employers. Weintraub's successors, however, have been concerned with giving a "face" to the faceless masses, with restoring their role in the making of history, and often with criticizing rather than celebrating the compromises inherent in the stability that Furuseth and his latter- day counterparts in the labor movement achieved. But Berwick is, at best, a throwback to the "old" labor history; his is a book in which the rank-and-file seamen remain largely faceless, a book that celebrates the achievement of a "great man" and assumes, implicitly at least, that *he* made history.

Not that this is mere hagiography. Berwick does recognize weaknesses in Furuseth, but he tends to see them as a reflection of the labor leader's single-minded dedication to the seamen's cause and therefore as an outgrowth of the very qualities he so admires. In many respects, Furuseth *was* unselfish and self-effacing; he spurned material comforts and was a deeply spiritual man. But there is little room in Berwick's biography for the opinion of Walter Macarthur, an SUP official who worked closely with Furuseth for many years and concluded: "Throughout his career as Secretary of the Sailor's Union and President of the International Seamen's Union, Furuseth has pursued the policy of browbeating and libeling every man who has shown a disposition to think for himself and to speak his own mind." Not only did the union's uncrowned king and his acolytes suppress discussion within the organization, but, Macarthur charged, "in some instances heads were broken in the attempt to 'persuade' Furuseth's critics to accept his leadership." So deeply was "Old Andy" convinced of his own rectitude that he was willing to ride roughshod over democratic procedure to enforce his will.

One would scarcely know it from reading Berwick's biography, but Furuseth was also a thoroughgoing racist. So were most of his contemporaries, and nowhere more so than in the labor movement on the West Coast, where, as Alexander Saxton brilliantly demonstrated in *The Indispensable Enemy* (1971), Southern white attitudes toward African Americans had their counterpart in Western trade unionists' fanatical hostility to Asian immigrants. In testifying on behalf of the Seamen's Act, Furuseth candidly declared that "we are trying to keep the sea for the white race"; he saw the increasing use of Chinese and Filipino seamen on American vessels as "a peril to Christian civilization." According to Weintraub, "Few labor men, even on the West Coast, outdid Furuseth in the chauvinism he voiced on this question."

I must conclude with one more criticism, the most serious of all. I want to preface it by saying that apart from this criticism I have no axe to grind with Arnold Berwick. As a professional historian, I welcome the writing of history and biography by dedicated amateurs who are animated by a deep affection and respect for their subjects. I have no predisposition to judge their work harshly. But in this instance I have discovered something that approximates — and on occasion clearly *is* — plagiarism. Berwick rarely cites his sources and includes no notes or bibliography at the end of his book. But in one case I recognized all too clearly a source that he was paraphrasing, and in some cases quoting exactly, without acknowledging it, because that source is my own book, *Workers on the Waterfront: Seamen, Longshoremen, and Unionism in the 1930s* (1988). (I invite readers of this journal to compare pages 52-55 of my book with pages 137-39 of Berwick's.) Perhaps imitation is the sincerest form of flattery; perhaps I should be flattered. But there are clear rules of engagement in the world of scholarship. Unfortunately, Berwick has violated them, and it seriously compromises the integrity of what otherwise — for all its shortcomings — appears to be an authentic labor of love.

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DAVID L. VALUSKA, *The African American in the Union Navy, 1861-1865* (New York: Garland Publishing, 1993). 353 pages. ISBN 0-815310-08-0. $76.00.

"The story of the black seamen" in the Civil War, writes David L. Valuska, "suffers from a strange malady; it has been both overstated and ignored" (p. 96). Valuska set out to cure that malady in his Ph.D. dissertation submitted to the history department of Lehigh University in 1973. At long last, after revisions and the addition of an index, it has been published. *The African American in the Union Navy* is a welcome addition to Civil War scholarship and to the growing subfield of African American maritime history.

Valuska recognized that the vast historical literature concerning the Civil War contained no full-length study of African American naval sailors. Given that the Civil War was the African American's war for independence; given that the navy played a crucial role in both coastal and riverine military operations; and given that both free men of color and self-liberated "contraband" slaves served in the Union Navy, black Civil War sailors truly had been "ignored." Their role simultaneously was "overstated," according to Valuska, because the most important previous investigation — Herbert Aptheker's "The Negro in the Union Navy," published in *The Journal of Negro History* in 1947 — claimed that blacks provided about 25 percent of Union Navy manpower. Aptheker had checked muster rolls from three ships and had also relied on an estimate made in 1902 by the Superintendent of the Naval War

Records Office. His pioneering conclusions were necessarily tentative. A more systematic and comprehensive research strategy, Valuska believed, might well reveal accurately the magnitude of African American participation in the Union Navy.

To that end, the author carefully scrutinized over 117,000 individual sailor's enlistment records to compile rosters of black enlistees. The results comprise two-thirds of this book: a series of appendices, arranged by year, consisting of the names of 9,596 men of color who enlisted in the Union Navy. Each name is accompanied by the enlistee's age, previous occupation, place of origin, place and date of entry into the navy, and naval rating. These appendices testify to the author's perseverance in the archives, and they will be a boon to genealogists, local historians, and naval historians interested in African American Civil War sailors. The appendices are also archly revisionist. Aptheker's estimates, Valuska confidently wrote, were grossly inflated: rather than comprising 25 percent of Union Navy manpower, blacks represented "only 8 percent of the total strength for the years 1861-1865" (p. 82).

Along with the appendices, the book contains a monographic essay on black sailors in the Union Navy. Its six chapters provide background on the maritime experiences of black Americans before the Civil War, an examination of the navy's tortured policy formation vis-a-vis black enlistees, and a survey of race relations in the navy.

The author's stated goal, among others, was to provide a "new sense of pride in black accomplishments and a greater awareness of Negro contributions to American history" (p. 120). The book honors black contributions, but not — as an ethnohistorian might have written — from the perspective of black sailors. Written from the vantage point of a historian concerned with the nation's story, this book's most important dimension is its blow-by-blow account of the government's struggle to articulate a consistent policy regarding the role of blacks in the Union Navy. Desperate for manpower by 1862, Union naval officials wanted black men to heave coal, tend boiler fires, and man small boats in the Union squadron. But many of those same officials wished to perpetuate the fictions that the United States was a "white man's country," and that the Civil War was about disunion, not slavery. As a result, "free Negroes were recruited through normal channels with restrictions upon ratings; contrabands were enlisted with even greater discriminatory guidelines" (p. 23).

Valuska's analysis of race relations could be more nuanced and attentive to specific encounters rather than to large generalizations. "Friction between black and white shipmates was inevitable," he writes, without attempting to delineate exceptions to that generalized rule (p. 67). In my opinion, Chapter Four, entitled "The Same Protection to All," accepts too literally that administrators' desire for a smoothly operating naval service provided "a measure of equality for African Americans" (p. 76). Valuska argues that "the integration of the races made it almost impossible for the Navy to adhere to two administrative policies — one for whites and one for blacks" — and he cites the disposition of court martial cases to substantiate his point. But he minimizes many forms of discrimination both subtle and blatant. For instance, during the Civil War black and white sailors were sometimes exercised *separately* at great guns and small arms, in a significant deviation from the more truly integrated naval procedures of the Revolution or the War of 1812.

Publishing a manuscript twenty years after its creation provides an interesting window on the construction of history. The book is somewhat dated in its language, its assumptions, and certainly in the secondary sources it cites. But Valuska's impressive lists of African American naval enlistees and his detailed rendering of naval policies with regard to race are as important now as they were twenty years ago. Whether or not his assertion that black men comprised only 8 percent of the Union Navy will remain unchallenged remains to be seen. As I write this review, the Department of the Navy has commissioned Howard University and the National Park Service to identify the names of all known African Americans who served in the Union Navy. They propose to examine not only the rendezvous reports that Valuska used but also ships' muster rolls, shipping articles, and miscellaneous enlistment records. Historical studies are always tentative — interim reports based on the best information then available. In terms of the actual number of enlistees, Valuska may not have the last word. But then, few of us do. He has the satisfaction, however, of having illuminated a long-ignored topic and having made a substantial contribution to the ongoing scholarly conversation about the roles of black men in the Union Navy.

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Eric W. Sager, *Ships and Memories: Merchant Seafarers in Canada's Age of Steam* (Vancouver: UBC Press, 1993). ISBN 0-774804-43-2. $29.95.

Eric W. Sager is the foremost authority on Canada's deep-sea shipbuilding and shipping industries. His complementary analyses, *Seafaring Labour: The Merchant Marine of Atlantic Canada, 1820-1914* and *Maritime Capital: The Shipping Industry in Atlantic Canada, 1820-1914,* with Gerald E. Panting (Montreal and Kingston:

McGill-Queen's University Press, 1989, 1990), are the starting point for any student of the field. They represent the culmination of over two decades of activity by a variety of scholars, grouped in a number of organizational guises, based on the Maritime History Archive at Memorial University of Newfoundland at St. John's. While much of the research was cumulative and collaborative, it was Sager who finally pulled the material together and rendered it comprehensible and accessible. Indeed, accessibility is an issue of particular concern to Sager. He has written eloquently on the responsibility researchers have to convey their findings to the wider scholarly community and has exhibited occasional frustration with an all-too-prevalent tendency toward profitless accumulation and debilitating disputation. (See Eric W. Sager, "The Atlantic Canada Shipping Project: A Retrospective and Rejoinder," *Newfoundland Studies* 5, no. 1 [Spring 1989]: 61-8.) While, as he notes in the introduction to *Ships and Memories,* none of his books has reached the status of a best seller, they have had an impact on the way Canadian history is written and have altered many a survey lecture.

The quest for accessibility is pressed one step further in *Ships and Memories.* This time Sager's goal is to reach beyond the community of his peers. "History is too important to be kept inside the ivory tower," he writes, "so the professional historian has . . . a duty to try and present history to the general reader and to recount the past in a way that lends it meaning and force in the present." The question is how? The very command of theory and method that makes historians professional renders their work often indecipherable to outsiders, while their attraction to why and how is tedious to those interested in who and what. In practice this means that professionals depreciate what the public wants, a good story. Sager, however, sees "nothing wrong with the use of anecdotes or stories in history, so long as we recognize that history is more than just storytelling." The key is to ensure that historians "discover the meaning in, and the conditions behind, the story."

This can be achieved, he believes, by the effective use of the memories embedded in oral history. "Precisely because it is the universal means of relating to the past, memory may serve as the basis of a truly popular history," a means to bridge the "gulf between history as an academic discipline and history as the general reader would like it to be." Such, at any rate, is the operating assumption behind *Ships and Memories.*

The memory to be explored here is not, the practical limitations of the human condition being what they are, of the Canadian merchant marine in the largely wind-driven heyday of 1820 to 1914. Rather, Sager wishes to understand the world of Canada's merchant seafarers in the steam-driven period running from the 1920s to the 1950s. This was anything but a golden age for the industry, characterized as it was by cycles of boom and bust, wartime expansion and peacetime decline. The consequent irregularity and uncertainty of employment opportunities were exacerbated by a general trend toward concentration of ownership in fewer and fewer hands. Together these conditions spawned the militant and class-conscious Canadian Seaman's Union in 1936. It is this cause and effect that provides the organizing principle behind *Ships and Memories.* Sager, selecting from over four hundred hours of taped interviews conducted with retired seafarers in the 1980s, either by himself or by Jim Green and the Canadian Seamen's Union History Project, fashions a series of chapters — Yarns, Going to Sea, Work, Officers and Masters, Class, Family, Masculinity, Hazards, and War — which culminates in one on Union. As he writes, "the memories are theirs, the organization is mine."

How well does Sager succeed, then, at writing a history that will satisfy both academics and the general reader? Has he created a bridge of meaningful stories? Professional historians are likely to be the most dissatisfied with the outcome. In part this is so because we know little about this period in the history of Canada's merchant marine. We do not have post-1914 equivalents for Sager's monographs on seafaring labor and maritime capital. The half-dozen pages provided here by way of introduction are all the context we have into which to place the memories that follow. A great deal has to do with faith. Still, there is much of interest. Together the chapters on Work, Officers and Masters, and Class, despite their brevity, provide an indication of the complexity and shifting subtleties of implicit and explicit hierarchies aboard ship. The chapter on Family, with its atypical inclusion of tables for ages, residences, and monthly wages of crew, provides the kind of hard information missing elsewhere. And, of course, their are the voices of the participants, which academic historians should never forget.

What of the likely reaction of the elusive general reader? Certainly there are stories here that run the gamut from humorous to poignant. The tale of the attempt to obtain a berth on a sailing ship by a young Niels Jannasch, later the founder and first director of the Maritime Museum of the Atlantic at Halifax, alone is worth the price of admission. The reactions of and to Molly Kool, the female captain from Alma, New Brunswick, also make for a nice melding of the instructive and the entertaining. The many photographs are unusual, and the author's captions are particularly informative. On the other hand, and surprisingly, the chapters on Hazards and War are rather flat. Furthermore, at little more than 150 pages, there simply isn't much here. A more significant reservation is that the organizational principle, the changes in working conditions that led to the formation of the

Canadian Seamen's Union, may not reflect the past as the participants would themselves have constructed it. It is one thing to use their voices to establish Sager's point, another to establish their own.

In summary, *Ships and Memories* will likely, in equal measure, stimulate and frustrate both general and academic readers.

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DAVID H. GROVER, *American Merchant Ships on the Yangtze, 1920-1941* (Westport, CT: Praeger Publishers, 1992). 234 pages. ISBN 0-275943-37-2. $47.95.

Merchant shipping on the world's great rivers has exerted a strong fascination on many maritime historians. It is highly relevant from the point of view of general history as well, as commercial navigation on a main traffic artery is intimately linked with economic, social, and political developments of a vast hinterland. This is especially true in a phase of opening up the vast interior of a country for the external market, when rivers provided the easiest access. Therefore, riverine transport has been the subject of many studies of Western expansion in the Americas, Africa, and Asia. Moreover, in these frontier-like conditions, stories of the operation of foreign firms in a hostile and unstable environment, upset by political upheaval and social transformations, can even provide quite thrilling stuff. Several novelists, most notably Joseph Conrad, chose river transport as the setting of novels and stories, not just for the sake of suspense but primarily because its severe conditions offered an opportunity for an intimate analysis of the complicated and dynamic relations between east and west. Somehow they have sensed that the upstream voyages did lead into the dark interior of an unknown culture, as well as one's own.

Apparently this atmosphere of adventure, as well as genuine historical concern, prompted David Grover to write his study of American merchant shipping on the Yangtze — dubbed "the most dangerous natural waterway ever sailed by Americans" — in the interwar period. His monograph is a very useful contribution to the subject, especially because of his extensive and critical analysis of source material retrieved from a large number of archives and collections. It is complementary to studies of the role of the U.S. Navy, some business histories of major companies, and accounts of well-known incidents. The author is very helpful to the reader in carefully pointing out how his account of events relates to existing studies — where it is an extension, rectifies errors, amends previous interpretations, and so on. This does not imply that the book is a miscellaneous collection of loose ends; it offers a coherent and comprehensive survey.

Grover's commitment to meticulous historical fact-finding and reconstruction does not detract from flowing storytelling. As a matter of fact, he emphasizes the aspect of struggle by dramatizing the composition of the narrative. In Part One he describes the Yangtze basin as an arena where natural and social geography formed a barrier as well as a challenge for American companies. Part Two introduces the players: Standard Oil Company of New York (Socony), the Dollar Line, the Yangtze Rapid Steamship Company, and several minor companies, now rescued from oblivion. Grover points out their remarkable differences and gives special attention to the mutual support of American commercial companies and the American navy. Part Three highlights the contests against demons and shipwrecks as well as against commandeering, piracy, and contraband (notably opium and weapons). The demise of American merchant shipping on the Yangtze comprises Part Four, which concentrates on two affairs: the Communist kidnapping of an American captain named Baker and the Panay convoy incident.

An even more important rhetorical device for enhancing the suspense is to put the scene in the perspective of the American frontier. In his preface the author states that "the frontier-oriented point of departure makes it easier to view and enjoy the remarkable saga of Yankee mariners on the Yangtze from this simple perspective of high adventure rather than try to understand the story against the backdrop of the complex forces that have influenced modern Chinese history." His account is based on the simple premise that ". . . what happened to these adventurers on the Yangtze River at that time was an extension of the westward movement in American history, the ultimate destination of the turn-of-the-century spirit of 'Manifest Destiny' and a final American frontier."

Grover's use of the concept of frontier in this context is unfortunate, however, since it leads to a rather one-sided and even misleading interpretation of Western navigation on the Yangtze in that particular period. It was not a predominantly American "movement" but a collateral of European navigation on the Yangtze-kiang. More insight could have been gained from a comparison of American, French, and British operations from a maritime, commercial, and political point of view. Nor was it a forward movement. As a matter of fact, after World War I the American presence on the Yangtze was less than before; it crumbled in the face of rising Chinese competition (about which little mention has been made). It had already largely disappeared before the Japanese invasion. After 1927 only the Yangtze Rapid Steamship Company survived; it dragged out its existence by adopting "Chinese business practices" and by its involvement in opium and other contraband until its demise in 1935. Its infringements on the official American "open door policy" created a rift between the commercial company, the navy, and political officials, which contributed to the erosion and disintegration of what was left of American authority in China. The kidnapping affair and the Panay incident bear witness to an inglorious if not humiliating retreat. So it might be doubted whether the disarray of American commercial and political activities in the Yangtze basin should be hailed as frontier heroism. The story might have been better told as part of the aftermath of imperialism. More attention should have been devoted to the commercial policy and practices, as well as to the technological aspects, of both Western and Chinese river navigation. After all, the suspense of shooting and smuggling is not the most interesting part of the story. More important is the long-term impact of American commercial operations on the Yangtze, which nowadays is once again on the threshold of great socio-economic changes.

Not all historians are convinced of the benefits of the open door policy in China. In his epilogue, Grover acknowledges that "Neither the Nationalists nor the Communists have any reason to regret the passing of foreign gunboats and merchant ships from the river." On the other hand, the author confidently clings to the opinion that "from the Western perspective the operation of American and European ships upon the Yangtze, while it may have engendered mutual distrust between China and those nations doing business on the river, did not harm the Chinese economy, and may have been modestly beneficial." Unfortunately, he does not provide any evidence on this crucial point. Questionable is his view that "Americans created a partnership between government and the private sector that showed that western forms of capitalism, imperfect as they might be, could be brought into an underdeveloped country without trampling upon the basic institutions and culture of the host nation. . . . Perhaps, in addition to camaraderie, even some of the democracy that Turner saw as the leveling agent of the frontier was at work on the river" (p. 190). The simple western-like opposition of right and wrong offers another display of moral complacency. The blatant imagery of "civilization versus savagery" (p. 1; p. 191) betrays a Kipling-like martial mood, whereas the real suspense of the story is struck with Conradian gloom and doom.

So we can sum up the merits and limitations of this study in a single sentence: It offers a thoroughly documented and well-written story, told from a rather limited and one-sided point of view.

J. N. F. M. à CAMPO

Erasmus University, Rotterdam

JERZY GAWRONSKI, BAS KIST, ODILIA STOKVIS-VAN BOETZELAER, *Hollandia Compendium: A contribution to the history, archaeology, classification and lexicography of a 150 ft. Dutch East Indiaman (1740-1750)* (Amsterdam: Elsevier Science Publishers and Rijksmuseum, 1992). 529 pages. ISBN 0-444894-15-2.

WERNER LAHN, *Die Kogge von Bremen, Bank 1: Bauteile und Bauablauf (The Hanse Cog of Bremen, Volume 1: Structural Members and Construction Process)* (Hamburg: Schriften des Deutschen Schiffahrtsmuseums Band 30, Ernst Kabel Verlag, 1993). ISBN 3-822501-86-7.

Two outstanding publications resulting from shipwreck excavations have been issued recently by presses in the Netherlands and Germany. Although very different in subject matter, presentation, and format, they represent milestones in maritime archaeology. They are absolutely essential references for the maritime archaeologist, but modelers, nautical historians, and museologists will find them extremely useful as well.

The Dutch East Indiaman *Hollandia* sank on 13 August 1743 in the Scilly Islands, with the loss of all 276 crew and passengers on board. The site was relocated in 1971 and salvaged over a period of several years. Although many of the recovered artifacts — coins and other objects made of precious metals — were dispersed in the salvors' auction, several thousand were acquired by the Rijksmuseum in Amsterdam where they have since been conserved, identified, and studied. Thus, this beautiful and imminently useful book concerns itself with the commonplace, base metal artifacts that the salvors could not sell, i.e., the dregs of the collection. The editors of this book do not draw attention to this point, but if ever one needed an example of the difference between archaeology and salvage, here it is. The salvors sold the shiny pieces at auction, leaving nothing to posterity. It was left to professional archaeologists and historians (for whom each object was important, regardless of its "market value") to study and care for each individual item, to bring order to chaos, and to make the most of the resource.

The *Compendium* is actually far more than its name implies, and its potential uses are manifold. Although the artifacts in the catalog are only those from *Hollandia,* they serve as the nucleus of a much wider study which encompasses the wreck sites of several other East Indiamen as well as historical information preserved in the VOC archives. The book is divided into four sections: Archaeology (the strategy behind the museum's archaeological and historical research into Dutch East Indiamen); History (the configuration of East Indiamen between 1740 and 1750 based on archival information); Inventory (everything normally carried by an East Indiaman on an outbound voyage); and finally, *Hollandia*'s artifact catalog.

In the first section, archaeologist Jerzy Gawronski discusses the special properties of shipwreck sites and the promise of underwater archaeological research. The historical-archaeological discipline developed by Gawronski and his colleagues explains the book's somewhat unusual organization and presentation.

The second section, written by the curator of Dutch history at the Rijksmuseum, Bas Kist, consists of a brief but very illuminating history of the Dutch East India Company, focusing on changes in ship design instituted between 1740 and 1750 in response to a perceived need to improve the seaworthiness, efficiency, and speed of the Company's ships. Unfortunately, the title of this section, "VOC Shipbuilding Policy 1740-50," does not reveal the fact that it contains rigging and sail plans, lines drawings, and lists of dimensions for masts, spars, sails, and rigging.

The third section, authored by Odilia Stockvis-van Boetzelaer, is entitled "The Equipagie Lyste of the VOC." It consists of a lexicon (inventory) of the equipment, stores, furniture, and armament aboard a mid-eighteenth-century Dutch East Indiaman. Derived from three VOC inventories (the main inventory book of the general equipment of an East Indiaman, a list of various captain's cabin necessities, and a list of medicines and surgical equipment), objects on the list are classed by function and, where necessary and possible, illustrated.

The fourth and largest section, also by Gawronski, is a catalog of the thousands of artifacts resulting from the *Hollandia* salvage. Each artifact is identified according to its find number, site location code, description, type of material, dimensions, and how many were found. Where possible, a drawing of the artifact is included. The discussion which precedes the catalog describes *Hollandia*'s discovery and salvage in the 1970s and contains site plans on which the distribution of finds is indicated.

Each chapter contains its own list of references and, where appropriate, instructions for use, notes, and summary. Chapters three and four are thoroughly indexed. All chapters are adequately and abundantly illustrated. For researchers with a particular interest in Dutch East Indiamen, this book must constitute the be-all and end-all of references, but it will be nearly as helpful to any historian, maritime archaeologist, ship modeler, and nautical enthusiast with a serious interest in the outfitting and organization of large sailing ships. Considered together, the lexicon and artifact catalog comprise a complete inventory of material culture contained in a mid-eighteenth-century Dutch East Indiaman. As such, it will be invaluable to maritime archaeologists seeking to identify objects, or fragments of objects, recovered from virtually any shipwreck after 1500 A.D. In a larger context, the appearance of this book is a sign that shipwreck archaeology may be moving out of its "look what I found" phase and developing into a legitimate scientific discipline.

The publication on the Bremen Cog is the latest installment in what must surely be one of the most intensive and comprehensive maritime archaeology projects ever attempted. In 1962, workmen dredging the river Weser near Bremerhaven discovered what appeared to be the remains of a well-preserved ancient ship. It was immediately recognized that the ship was most probably a medieval cog, an important ship type about which little was known until this archaeological example was recovered, studied, and reconstructed. Dated to A.D. 1379-80 by dendrochronology, the Bremen Cog seems to have been built in Bremen but never actually sailed. Carpenters' tools and supplies were still on board, but there was no trace of a cargo. Archaeologists concluded that the cog was torn from its pier during a spring flood before its construction was completed and was swept down the Weser to capsize and sink on a shallow bar.

The cog was remarkably well preserved. Undaunted by its dimensions of twenty-two meters (about eighty feet) in length, eight meters (about twenty-six feet) in beam and four meters (about thirteen feet) of hull height, archaeologists and conservators determined to save the ship and reconstruct it. It is probably just as well they did not know the magnitude of the commitment they were making. Although the ship's timbers are still undergoing conservation treatments, many studies (e.g., dendrochronology, wood conservation, experimental archaeology, and Hanseatic League research) have been completed. *Die Kogge von Bremen,* however, is limited to describing the design and construction of the best-preserved cog ever discovered.

This unique publication consists of a well-illustrated, softcover, 250-page report, a fifteen-page German-to-English word list for use with the plans, and thirty-seven oversize reconstruction drawings up to forty-two inches in length — all bound together in a cloth-covered box eighteen inches long, thirteen inches wide, and more than two inches thick. The plans are at 1:5, 1:10, and 1:20 scale and include drawings of the actual remains, reconstructions of missing or partially preserved members, and lines drawings of the hull as it would have appeared originally. Those who do not read German will scarcely be inconvenienced: The German-English word list is comprehensive, and an English summary follows each subsection of the report. In many cases the illustrations speak for themselves.

Following a brief introduction, the body of the report describes the piece-by-piece building of a cog from laying the keel and erecting the end-posts to installing the rail and bevelling the toilet seat! The degree of detail is quite remarkable. Modelers will be interested to know that every one of the more than two thousand separate parts recovered in the excavation is accounted for in the plans, and the last eighty pages of the report contain lists of the dimensions of virtually every timber in the ship. The book's title seems to indicate that this is the first volume in a series. If so, I can hardly wait to see the next one.

Both books make an important point almost subliminally. Shipwrecks are an important subset of all archaeological sites. Their potential for providing comprehensive information about the past is vast — and usually underrealized. Both publications were prepared by museum staffs. Perhaps only museums can accomplish the long-term, labor-intensive studies necessitated by such ambitious projects: the Bremen Cog was discovered in 1962 and *Hollandia* in 1971 — thirty-two and twenty-three years ago, respectively! In a world full of flash and glitz, instant gratification schemes, and contrived superlatives, it is encouraging indeed to witness the appearance of such carefully crafted, thoughtfully researched books.

DONALD M. KEITH

Corpus Christi, Texas

SHORTER NOTICES

SIMON VILLE, ED., *Shipbuilding in the United Kingdom in the Nineteenth Century: A Regional Approach* (St. John's, Newfoundland: International Maritime Economic History Association, Research in Maritime History 4, 1993). Paper, xii + 195 pages. ISBN 0-9695885-3-4. $15 (available from IMEHA, Maritime Studies Research Unit, Memorial University of Newfoundland, St. John's, Nfd. A1C 5S7).

This fourth volume in a valuable reference paper collection concentrates, as the title indicates, on British shipbuilding. Six papers, all presented at the First International Congress of Maritime History, Liverpool, 1992, were solicited and arranged by Ville to present a comprehensive overview region by region. Ville deals with the northeast, Sarah Palmer with southeast England, David Starkey with the southwest, Frank Neal with the northwest, Anthony Slaven with Scotland, and Michael Moss with Ireland. Each author supplies the necessary supportive data and source citations along with a number of pertinent illustrations. The result is an interesting comparison of rates and patterns of growth, showing clearly — and attempting to explain — the steady growth of shipbuilding in the northeast, Scotland, and Ireland, and the simultaneous decline of the other three areas over the same century. The collection is uncommonly coherent, since each author basically asks the same questions. It is clearly important to economic historians, but it should also be brought to the attention of anyone interested in the economic side of nineteenth-century British history and what was then the world's most dominant shipbuilding industry.

WILLIAM DUBARRY THOMAS, *Speed On The Ship! A Centennial History of the Society of Naval Architects and Marine Engineers, 1893-1993* (Jersey City, NJ: Society of Naval Architects and Marine Engineers, 1993). Paper, 205 pages, illustrations. ISBN 0-939773-13-9. $30.

HENRY BENFORD AND WILLIAM FOX, EDS., *A Half Century of Marine Technology, 1943-1993* (Jersey City, NJ: Society of Naval Architects and Marine Engineers, 1993). Hard cover, 616 pages, illustrations, ISBN 0-939773-12-2. $45.

These two volumes together commemorate the centennial of the Society of Naval Architects and Marine Engineers. *Speed On The Ship!*, available in softcover only, is a year-by-year chronology which describes in considerable detail each annual meeting of the Society, noting papers given, membership trends (including deaths of individuals), awards presented, and so on. Appendices illustrate and discuss the career of each of the Society's thirty-three presidents and list the membership over the century.

A Half Century of Maritime Technology presents a completely different format. Some sixty separate papers, each by a competent expert, discuss a wide range of topics divided into eleven categories. Hull forms, structural materials, powering, propellers, tanker cargo systems, computers, shipyards, ship types (for example, bulk carriers, LNG carriers, warships, coast guard cutters, tugs, and so on): there is a considerable mine of valuable reference material gathered into this single volume. Not surprisingly, American developments are featured, but at least six of the contributions deal specifically with Canadian subjects. Most chapters provide references and suggestions for additional reading. Although the era considered begins in 1943, readers will find that in fact most of the papers reach back to the beginning of the war years. Considering that this is an oversized volume which includes more than five hundred photographs to illustrate material often difficult to track down, the price seems most reasonable. Overall, this is a most useful volume for any maritime reference collection.

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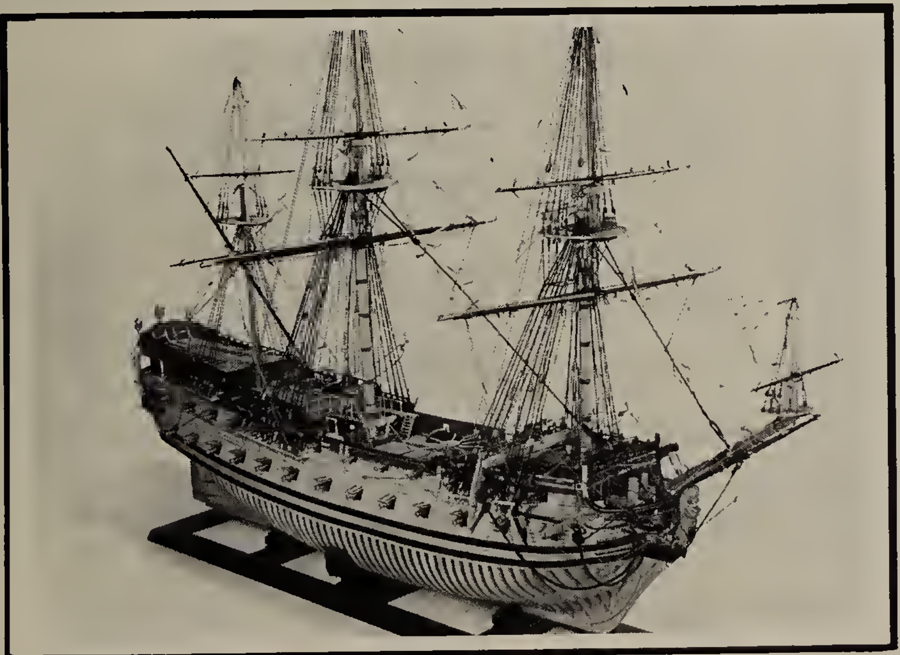

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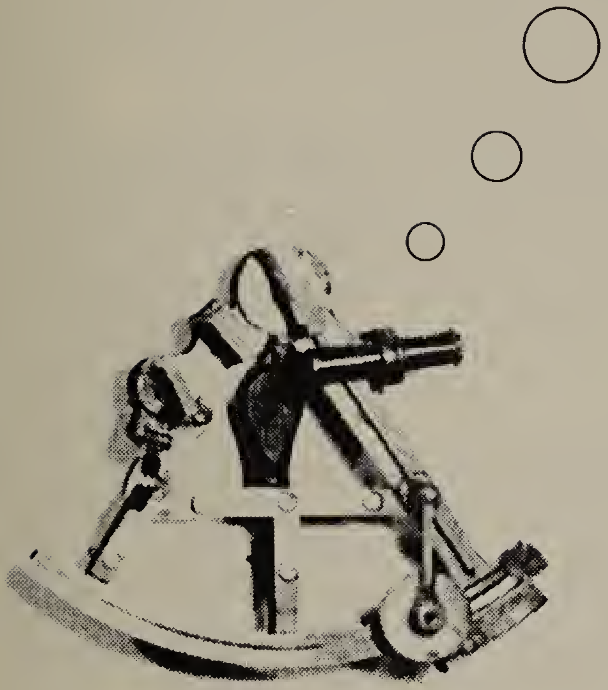

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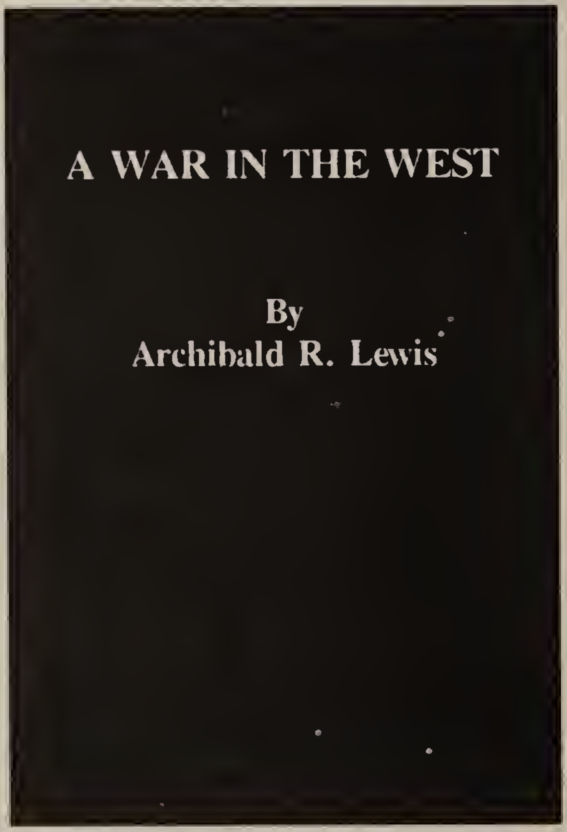

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